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The Electricity Commissioners' Report.

ON Saturday last the sixth annual report of the Electricity Commissioners reached our hands—delayed, no doubt, by the pressure of work imposed upon them and their staff by the efforts of the Government to secure a safe passage for the Electricity (Supply) Bill through Parliament. That measure is now on the point of arrival at its journey's end, and by the end of the next five years, as indicated by the Attorney-General, may come to fruition. But at the moment we are invited to look back over the period from April 1st, 1925, to March 31st, 1926—approximately coinciding with the interval between the submission of the Weir Committee's Report and the publication of the Bill.

As in the case of their fifth annual report, the Commissioners again excuse themselves for delay in the prosecution of new schemes on the ground that they were necessarily influenced in the exercise of their duties to avoid any course of action in connection with the reorganisation of supply which was likely to bring about results not in conformity with the policy of the Government. Possibly the industry would be much better off, and might make more rapid progress, if the Government had no policy—so far, its interference has unquestionably helped to delay development and to foster that alleged "backwardness" with which its mouthpieces continually and shamelessly reproach it. The Commissioners state that "in these circumstances, questions relating to schemes of transmission and schemes of control of interconnected generating stations in certain Electricity Districts were deferred" by them, "for further investigation at a later stage in the light of the Government proposals, and a similar course was followed in the case of some of the more important applications made to the Commissioners for consent to proceed with the establishment of new generating stations." It is a sad story, twice told; we are sure that no one regrets the delay more than the Commissioners themselves, and they proceed with an air of relief to "other aspects of electrical development which were not affected to the same extent by the impending legislation, such as the inauguration and extension of distribution works," in which branches "the year under review was marked by considerable activity."

At the end of March last, the number of authorised undertakers in Great Britain had increased by 28 to 596 (including two Joint Electricity Authorities and three Joint Boards). The electricity generated at 483 stations of authorised undertakers amounted in 1925-26

to nearly 6,700,000,000 kWh, and adding the output of 52 railway power stations, 26 tramway stations, and 23 non-statutory undertakings, the grand total for 584 stations was nearly 8,123,000,000 kWh. The coal and coke consumed was about 8½ million tons, and oil fuel 38,810 tons. The output showed an increase of about 9.5 per cent. over the previous year, and the coal and coke consumed an increase of about 5.2 per cent., but oil fuel decreased by over 28 per cent. Compared with 1921, the output had increased by 57.2 per cent., and the consumption of coal and coke by 14.2 per cent.—very satisfactory figures, though the increase of output compared with 1924-25 was regrettably low. Five stations each produced over 200 million kWh; but 428, or 73.2 per cent., produced less than 10 millions each. Twenty stations were shut down, and twenty others came into operation, including those at Barking, Agecroft, and North Wilford.

The "units sold" by authorised undertakers amounted to 5,515 million kWh, or 125 kWh per head; this figure does not include the consumption of electricity by railways and tramways, or that generated at private power stations, which would put a different complexion on the situation. Adding 80 per cent. of the generated output of the former, the consumption becomes 6,655 million kWh, or 150 kWh per head; and if we add the Electricity Commissioners' estimate of 1924 for private industrial supplies, the total consumption of electricity for all purposes in Great Britain during 1925-26 was 220 kWh per head—a figure quoted by Sir John Snell before the Coal Commission.

The Commissioners sanctioned new plant of an aggregate capacity of 585,700 kW during the year, and authorised the expenditure of £9,685,301 by local authority undertakers. Their own net expenses amounted to £44,098.

An abstract of the Report will appear in later issues.

The Radio Manufacturers' Association.

In this issue we report the proceedings at the inaugural meeting of the Radio Manufacturers' Association which has arisen from the "ashes" of the N.A.R.M.A.T. and the Society of Radio Manufacturers.

The new body has inherited the offices and staff of the N.A.R.M.A.T., but not all of the membership of that body. At the date of the meeting there were 43 members, but there are no doubt a number of manufacturers who are standing aside until they see what kind of body the R.M.A. is. It may be said, however, that the new Association is thoroughly representative of the two bodies which it supersedes, for the interim committee charged with the management of affairs consisted of the executives of the N.A.R.M.A.T. and the S.R.M. Moreover, the companies to which the two former chairmen belong are to be represented upon the executive of the new Association.

The Radio Manufacturers' Association has a favourable start, and we trust for the good of the industry that it will have a clear course, for the radio industry is particularly susceptible to the evils which beset any young industry.

One matter arising out of the dissolution of the N.A.R.M.A.T. is the fact that the "A.T." section of that body has no place in the new Association. The latter has promised the members of that section a grant of £400 with which to form a new Retailers' Association. But there is already one such association in being!

Dangerous Toys.

We note with interest that the Home Office has issued an official warning with regard to the use of electric toy railways designed for operation off electric lighting circuits, pointing out that under certain conditions such toys may give rise to dangerous shocks. In January last we drew attention to the dangers associated with these toys, and whilst we deprecate alarmist statements, we feel that this is a class of risk for which no excuse avails. The grief and remorse that would becloud the lives of those who had lost a child in this way can hardly be exaggerated, and we trust that the publicity which has been given to the subject by the action of the Home Office will effectively prevent the sale of these dangerous foreign devices.

British makers of electrical toys usually design them for use with low-voltage accumulators or transformers, thus eliminating all risk of shock. The advantages of electrical operation are so manifold and the pleasures derivable from its use so great that it would be most regrettable if the warning were indiscriminately applied to all electrical toys, the harmless as well as the deadly ones; but the latter should be rigidly excluded from the home.

The Fuel Economy Amalgamation.

We have on previous occasions pointed out the futility of carrying on two institutions with exactly the same object—the promotion of the more economical use of fuel—and differing only in respect of one aspect of their constitutions, and we have expressed the hope that wiser councils would prevail, leading to the establishment of a single institution which would exercise far greater influence. We were very glad to learn, therefore, that at the autumn meeting of the Institution of Fuel Technology, which was held last week, Sir Alfred Mond, who fortunately was president of both bodies, was able to announce that at his instigation they had agreed to join forces.

Our hearty congratulations are due to Sir Alfred for his timely action, and to the advocates of fuel economy in general, both technical and otherwise, on the sane and public-spirited policy which has been adopted by the leaders of the two parties. There is now every prospect that a fully representative Association will emerge from the melting-pot, and that it will be capable of rendering most valuable service to the nation, without dissipating its strength by division or wasting time, energy, and money by overlapping. We regard the subject with which it deals as one of the first importance, and we look forward to its attaining a large membership and corresponding prestige.

A Threatened Industry.

One result of the Government's electricity scheme, which has not received consideration, is the effect it will have upon the engine-building industry. This country has led the world in the design and construction of steam and oil engines, such as are usually installed in small power stations. Now, if the proposal to concentrate all generation in large turbine stations is carried out, the home market for the smaller sets, including small and medium-sized turbo-generators, will be destroyed; moreover, whilst this process is going on, the market will be flooded with second-hand plant discarded by the small generating stations which are being shut down and converted to bulk supply sub-stations. It is an axiom in manufacturing industries that a secure position in the home market is essential to successful competition with the products of our foreign rivals in the markets overseas; it is to be feared, therefore, that the consummation of the Government scheme may seriously injure one of our most cherished industries, whether cheap power is available or not.

That there is still a place for the small power station usefully to fill is certain; and when crude oil obtained in quantity by the low-temperature carbonisation of British coal becomes available at a low price, as the Government itself confidently anticipates, it will be difficult for any super-power station, 20 or 30 miles from the consumers, to show as low a total cost as a local station driven by modern oil engines. Be it always remembered that the cost of distribution is by far the largest item in the total cost of electricity. Much harm has been done to electricity supply by the repeated promises of electricity at a penny or even less per kWh, a price which, if attainable on the average, will certainly not apply to all consumers and all classes of load.

Sir George Sutton, Bart.

Retirement from the Managing Directorship of Henley's Co.

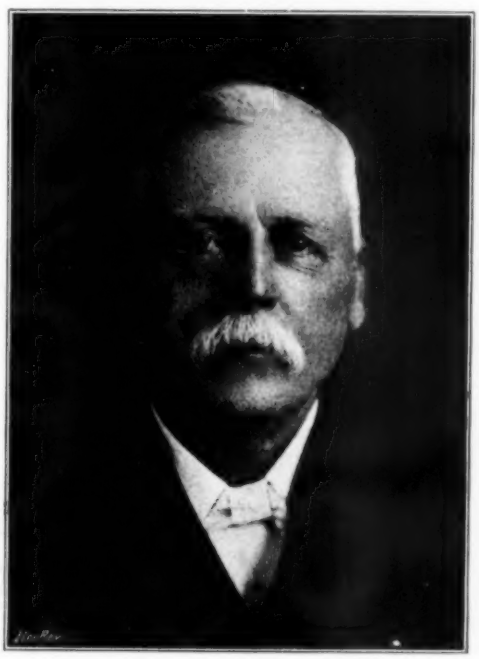
Generous Transfer of Shares for Workmen's Benevolent Fund.

ONE of the largest and happiest family gatherings that it has been our privilege to attend in connection with the electrical industry was held at the Hotel Russell, in London, on Tuesday evening last week.

It was arranged under the auspices of the Social Club which, during the last few winters, has brought together the office staff and employés of W. T. Henley's Telegraph Works Co., Ltd., for the enjoyment of dramatic and other events. The assembled company on this occasion included directors and leading officials and their wives, the London office staff, and a large staff delegation from the Gravesend and Woolwich works, but outside contract men and branches throughout the country and offices representing Henley's in all parts of the world were present in spirit, their regard taking practical shape in contributions towards the gold cigar box which was chosen to express the esteem and admiration felt by all concerned for the leader of the Company—Sir George Sutton, Bart.

Let it be stated at once that Sir George's retirement from the active managing-directorship does not mean that his interest in Henley's Company will cease, for, though he vacates one chair as managing director, he will occupy another as Chairman of the Board, thus continuing to bring his unique experience and influence to bear upon the operations of a company with which he has been so honourably associated for practically the whole of his career. As he told us last week, he will continue to make the interests of Henley's the chief object of his life.

Nearly 56 years ago he began his career in the City of London; in 1881 (just on 46 years ago) he was secretary of the company; later he became manager; subsequently managing director and chairman. In the year 1910 the shareholders, always so appreciative of his efforts, voted the sum of £1,000 for his presentation portrait to be executed by Sir Luke Fildes and for a service of plate for Lady (then Mrs.) Sutton. His Majesty the King conferred the honour of Baronetcy upon him in the year 1922. To the Jubilee Issue of the ELECTRICAL REVIEW, November 17th, 1922, he kindly contributed an article on "Cable Manufacture and the Cheapening of Electricity."



City Studios [*London.*

Sir George Sutton, Bart.,
Chairman of W. T. Henley's Telegraph Works Co., Ltd.

The proceedings last week took the form of a Bohemian concert. Sir George was accompanied by Lady Sutton, and the chair was occupied by Mr. Percy Rosling, M.I.E.E, the general manager of the company, who called upon Mr W. J. Potter (a director), who was the oldest member of the staff, and had been longer associated with Sir George than any other representative, to make the presentation.

Mr. Potter reported the receipt of many telegrams from home and foreign branches, and then became anecdotal. Failing to find words of his own wherewith suitably to describe their guest, he turned to the dictionary and found the following:—"Admiration, esteem, veneration, courtesy, considerate, kind, expert, efficient, able, intellectual, talented, gifted and benevolent." Should Sir George have any leisure in his semi-retirement he will find this record of virtues and qualifications pleasing to contemplate.

In the course of his reply, Sir George compared the conditions of City life to-day with those of 56 years ago. He said that they had built up the great Henley business by turning out best quality work and by selling it energetically. "Sales organisation and energy in selling are the principal factors to make a successful business." There was no foreign competition in those days, but there was competition at home; the situation was saved by the Cablemakers' Association. A successful business could only be established in a considerable period of time. Most great businesses had had small beginnings; a new department could not make profits at once. Later Sir George remarked that the dominating influence in his life had been to get work and make employment. That spirit influenced them to-day. After referring to the importance of finance and to the fact that the financial position of Henley's was second to none in the United Kingdom, the speaker dwelt sympathetically and at some length on the various Pension Funds of the Company. These stood at nearly £200,000, but there was no fund for the workers. He had been considering the problem for twenty years. The men in the workshops had done their share in building up the concern, and in seeking for a way to help them he had at last to turn to the Benevolent Fund. He could not look to the board further, for they were already providing £25,000 per annum for the Pension Funds and philanthropic work, so he had decided to ask the workpeople to accept a gift from his personal resources of 1,250 of Henley's ordinary shares (valued at £5,000 in the market), to be transferred to the Benevolent Fund and administered according to regulations which Mr. A. E. Salmon, the secretary, would have drawn up.

We wish we had space at our disposal to report the speech of Sir George in full, for when we are sometimes very deeply impressed with the difficulties attending the conduct of business to-day it is as well for us to be reminded of the strenuous life that pioneers of the electrical industry experienced forty years and more ago. When the foundations were being laid of businesses which are giving employment to many thousands of men and women now, the hours of work were long, there were few holidays, "we walked into the City because we could not afford to ride," telephones and typewriters did not exist, offices were ill-ventilated, even insanitary, and many like disadvantages marked those "good old times." The pace may be faster now, but the great effort put into some of the concerns whose names to us are electrical household words, in those far-off days kept their leaders at the grindstone well on to midnight for months at a stretch, and their reward has been well-earned.

Large Modern Electric Cable Works.

The Woolwich and Gravesend Factories of W. T. Henley's Telegraph Works Co., Ltd.

THE great businesses of the large British cable-making companies of to-day were built up in the past on the reputation they acquired for the uniformly high quality and long "life" of the cables and wires they supplied.

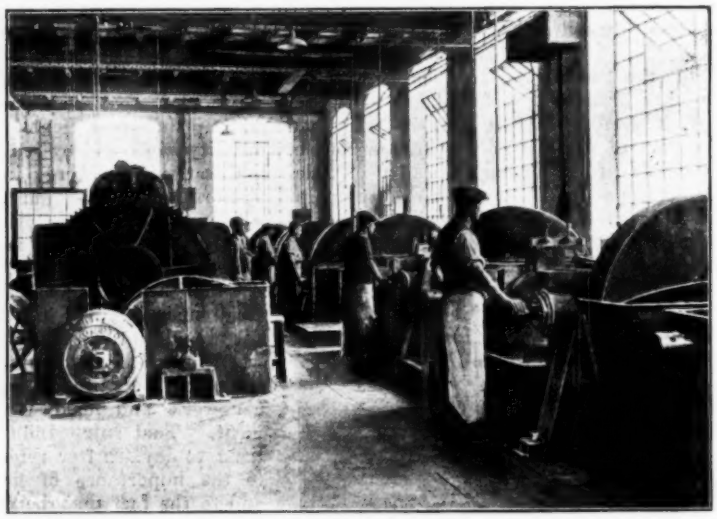


Fig. 1.—Rubber Mixing Mills.

Rigorous selection of raw materials, a long experience, and great care and skill in compounding and assembling the materials, produced electric cables and wires in this country which have set a standard for, and are unsurpassed anywhere in, the world.

Those same methods operate to-day, but there is now added to them in the best-equipped cable factories an organisation of scientific men and methods which the

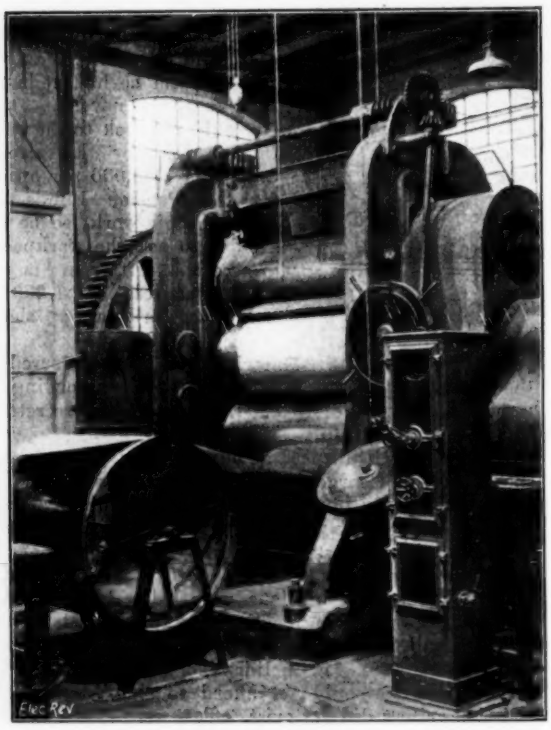


Fig. 2.—Sheet Rubber Calendar.

present-day tendency for increasing voltage has made essential.

Results obtained from operating experience on 4,000,000 ft. of three-core cable, purchased from 10 different manufacturers (including British) by the Commonwealth Edison Co., of Chicago, indicate that the best cable is, in general, made by those manufacturers who exercise the best control over their processes.

This conclusion was impressed upon us by observations made during a recent tour of the North Woolwich and Gravesend works of Messrs. W. T. Henley's Telegraph Works Co., Ltd., which company has made such remarkable progress under the able direction of its chairman, Sir George Sutton, Bart.

Laboratory work, carried on under the control of Mr. P. Dunsheath, O.B.E., M.A., B.Sc., A.M.Inst.C.E., M.I.E.E., in the company's Research Department has proved itself to be of the utmost value in the examination of materials and the checking of process operations in the factories. Under Mr. Dunsheath is a staff of scientists, physicists, and chemists, and the laboratory buildings, which are in themselves as large as many a successful factory, are complete with plant, machinery, and apparatus for every kind of practical experiment and scientific research connected with electric cable manufacture. As these laboratories have been fully described in the ELECTRICAL REVIEW,* it is not our present intention to deal with them, but with the

Fig. 3.—Plant for Making "Spread Rubber."

practical methods of cable-making in these two up-to-date works.

The North Woolwich Works.

The North Woolwich works, being the oldest of the company's factories, and standing on the ground where William Thomas Henley commenced his operations in the pioneering days of submarine cable manufacture on the banks of the Thames, will be dealt with first. This factory, under the management of Mr. Henry Savage, M.I.E.E., A.M.Amer.I.E.E., F.I.R.I., is chiefly concerned with the production of rubber-, gutta-percha-, and bitumen-insulated cables and wires and flexible cords.

The wire-drawing process is exclusively done at Gravesend, but the stranding operation is carried out at both works, whilst all the rubber plant is at Woolwich. The tinning of all wires is also done at Woolwich.

The raw rubber in sheet form is washed in special mills to remove impurities. The next process is

*See ELECTRICAL REVIEW, December 5th, 1924.

mastication, by which the rubber is rendered plastic to facilitate compounding. The various ingredients, such as chalk, zinc, sulphur, &c., are sifted and weighed into the requisite quantities for adding to the rubber

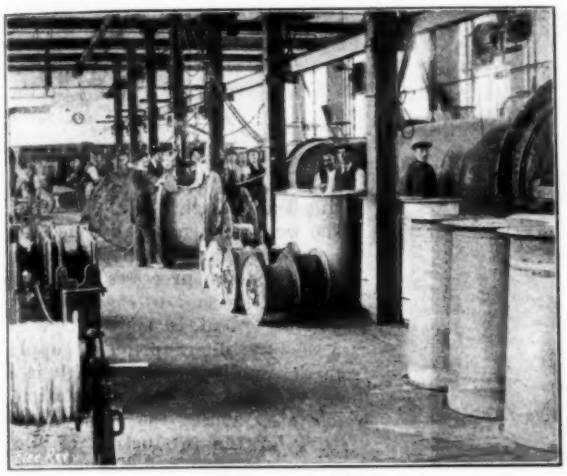


Fig. 4.—Cable Vulcanising Plant.

in the mixing mills, fig. 1, subsequent operations being stimulated by accelerators, *i.e.*, substances admixed in small quantities during compounding to reduce the time occupied in vulcanisation, or to permit of the

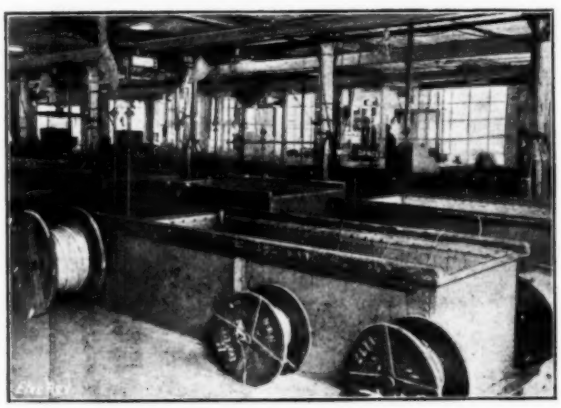


Fig. 5.—Water Immersion Tanks.

process being carried out at a lower temperature, and also to impart toughness or any desired modification of its physical properties. After being thoroughly compounded, the material is passed through a calendar, fig. 2, the rolls of which can be steam heated or water cooled as necessary to prevent the rubber being scorched; the calendar rolls are adjustable to 1/1,000 inch. The rubber sheet thus produced is allowed to cool and set before being cut into strips of various widths. This type of machine is used for manufacturing "sticky" tape (Henley tape), the rollers being set to revolve at different speeds to "friction" the rubber into the cloth.

Another process consists of printing the cable maker's name on rolls of calico, which is afterwards "proofed"; that is, covered with a thin coating of rubber compound, which is produced by mixing rubber paste with a solvent: the excess solvent is recovered by heat evaporation and drawn off through ducts, the "proofing" plant being, of course, enclosed for that purpose.

"Spread rubber," as its name implies, is made by covering calico with a layer of rubber mixed with a solvent, both being passed between rollers simultaneously, as indicated in fig. 3. After being allowed to mature, the rubber sheet is peeled off the calico, the latter being used over again, and the rubber sheet is cut into widths, depending upon the size of cable to be covered.

One coating of pure rubber strip and two coats of vulcanised rubber strip are generally used for insulating each conductor. They are run on longitudinally for the smaller size of conductor and spirally for the larger sizes. After being taped with "proofed" tape, they are wound on to large metal cylinders of a diameter to suit the size of conductor, and placed for the requisite period in steam-heated "curing" or vulcanising chambers, fig. 4. After curing they are placed for 24 hours in water tanks similar to those illustrated in fig. 5 and tested at 600 V d.c. This is the usual insulation resistance test, but sometimes

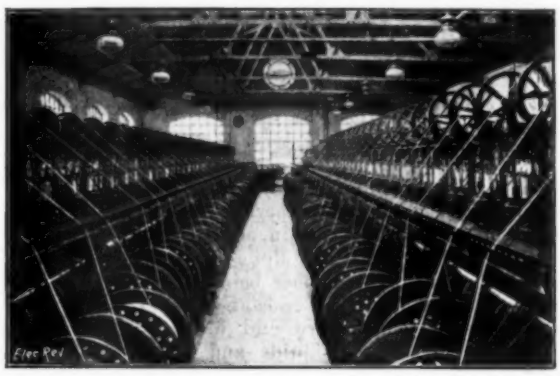


Fig. 6.—A Battery of Braiding Machines.

a.c. is used instead of d.c., depending upon the voltage for which the cable is designed. The testing plant is capable of going up to 40,000 volts at North Woolwich and up to 150,000 volts at the company's Gravesend works. When they have satisfactorily passed the pressure test, they are finished with a braiding of cotton or jute, or are covered with a seamless and continuous tube of lead.

A battery of braiding machines is illustrated in fig. 6. These machines carry a number of bobbins, on which the coloured thread is wound. Half the bobbins revolve in one direction and half in the other, passing in and out of each other criss-cross fashion so that the braiding is "woven" on to the cable. Flexibles are braided in this manner with silk or glacé cotton. Where armouring is required over the lead, a coat of compounded jute is first applied as a bedding

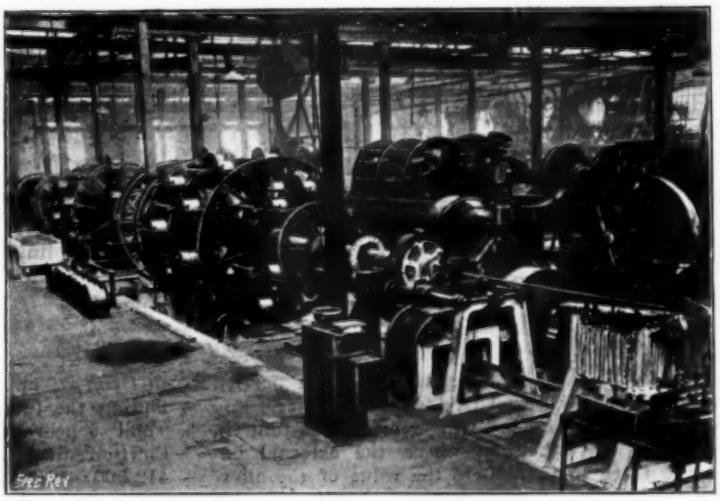


Fig. 7.—Wire Armouring Machinery.

for the armouring, which is applied by machines similar to those illustrated in fig. 7. In some cases the

armouring is left bright, and in others a serving of compounded jute yarn or hessian tape is applied over the armouring wires.

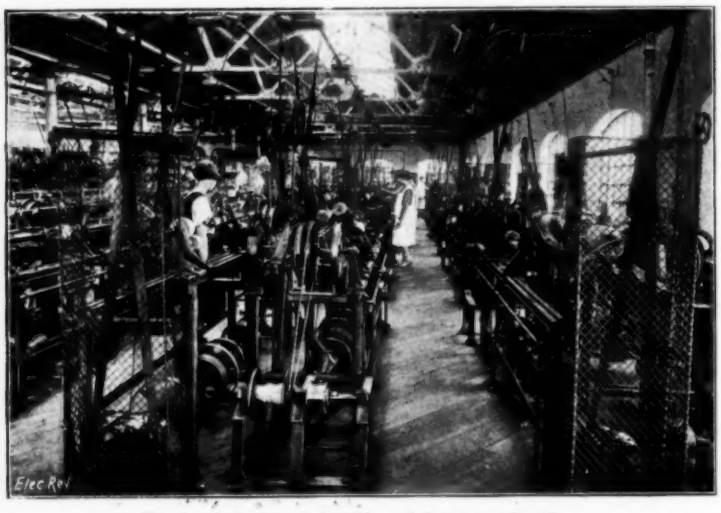


Fig. 8.—A Section of the Silk- and Cotton-covering Shop.

Vulcanisation effects remarkable changes in the physical and chemical properties of rubber by the action of sulphur and certain other ingredients, the elastic modulus and tensile strength of the rubber being greatly increased, and its resistance to changes of temperature and to the action of organic liquids and other chemical re-agents much enhanced. During the process of vulcanisation the rubber combines with a small portion of sulphur, while a large proportion (so that the vulcanisation coefficient may reach nearly 50) would produce "vulcanite" or "ebonite." It is because of the action which would take place between the sulphur in the rubber and the copper that the conductors of rubber-insulated cables must be tinned.

In some cases, such as cab-tire sheathed cables, the rubber is tubed on. Gutta-percha and vulcanised bitumen are also applied by the tubing process. The tubing process consists of applying the rubber, gutta-percha, or bitumen while heated through a die-mould. Cotton- and silk-covered wires for the wireless trade, for instrument work, and for telephone switchboard cables, &c., are produced at these works in enormous quantities, also cotton-covered flat copper strip for armatures. A section of the silk- and cotton-covering shop is shown in fig. 8. Enamel-insulated wires are also manufactured in large quantities by modern plant controlled by specially-engaged skilled operators. Wires down to as fine a diameter as 0.002 in. are passed through the enamelling bath and then over pulleys which run them backwards and forwards through a chamber heated to the proper degree for setting the enamel.

The works are, naturally, electrically operated throughout, but steam is generated for processes of manufacture, and stand-by electricity generating plant is maintained in case of any interruption of supply from the public mains. Fig. 9 is a view of part of the sub-station, which also houses the rotary convertors for the production of d.c. from the incoming 6,600-volt a.c. supply from the borough of Woolwich electricity station, the cables for the purpose passing under the river through the Woolwich footway tunnel. All materials are, of course, tested and checked electrically and mechanically at various stages of manufacture at both the Woolwich and Gravesend establishments.

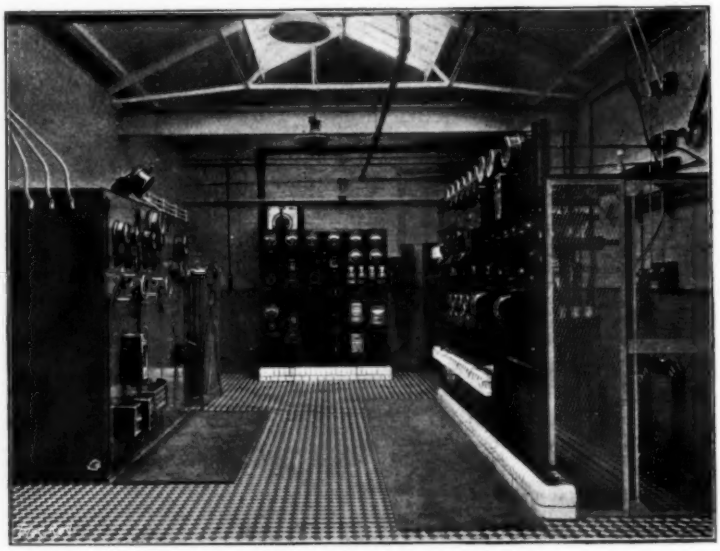


Fig. 9.—Part of the Woolwich Works Sub-Station.

(To be concluded.)

Short-Circuit Currents.

Calculations on a Large Interconnected Three-phase Distribution System.

By G. CLULEY, A.M.I.E.E.

(*Concluded from page* 945.)

In the case under consideration, the major portion of the impedance is external to the alternators, and consequently such portion will remain constant in value. Generally speaking, where the external impedance is three to four times the value of the alternator impedance, the initial short-circuit kVA is assumed to be the sustained short-circuit value, *i.e.*, the short-circuit kVA after the period of 0.2 second when the circuit breaker opens. In such cases where it is necessary to determine a suitable decrement factor, this can be approximated from the curve, fig. 9, by finding the total percentage impedance as follows:—Total synchronous plant capacity kVA × 100/initial short-circuit kVA, which in this case = 208,000 × 100/412,500 = 50.4 per cent., and from fig. 9 we find the decrement factor to be 0.96. Therefore the rupturing capacity of the oil circuit breakers would be 412,500 × 0.96 = 396,000 kVA.

We have now calculated the short-circuit kVA on the 110-kV busbars at sub-station B; similar calcula-

tions can be carried out for any particular sub-station by preparing in the first instance suitable impedance diagrams. Figs. 10 and 11 show impedance diagrams for the generating stations A and E respectively; it is not proposed to calculate these out in detail, as the method to be employed is identical with that carried out in connection with sub-station B.

Having once determined the total resistance and relative reactance on the main busbars for any particular sub-station, it is a comparatively simple matter

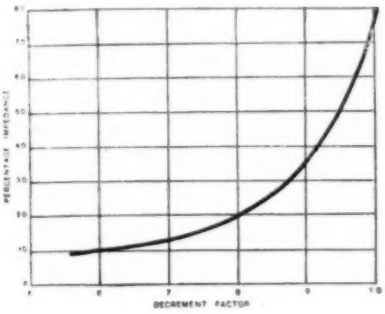


Fig. 9.

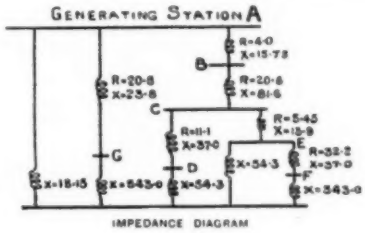


Fig. 10.

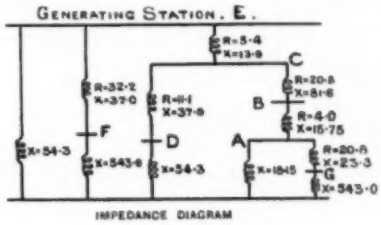


Fig. 11.

to determine the short-circuit capacity on any subsidiary busbar or circuit. As an example we will assume that sub-station B is interconnected with an 11,000-V town network and local generating station on a ring-main system, this being represented by fig. 12. It is not proposed to calculate the impedance of the interconnecting cables, as this, to a great extent, is duplicating examples already given; we will assume that the resistances and reactances are as shown on the diagram—the values given being actual at 11,000 volts. Since the main calculations have been computed relative to 110 kV, it is necessary to substitute relative values

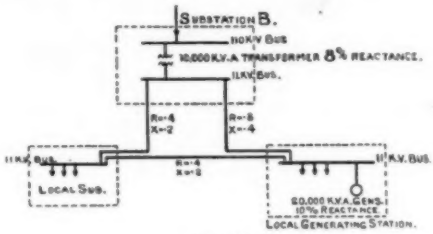


Fig. 12.

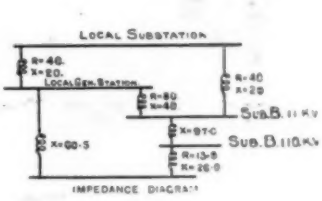


Fig. 13.

of reactance and resistance in the local net, also the reactance values for the local generating plant, and the step-down transformer at sub-station B must be relative to 110 kV. The first step is to substitute relative values of resistance and reactance for the net, and since we are basing our calculations on 110 kV for an 11-kV network, we must multiply the actual values by the square of the ratio of the voltages for an equivalent power transmission; therefore the actual resistance

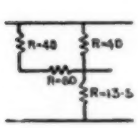


Fig. 14.

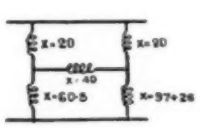


Fig. 15.

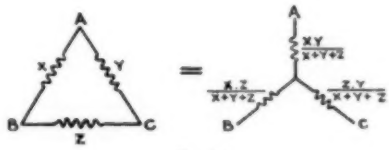


Fig. 16.

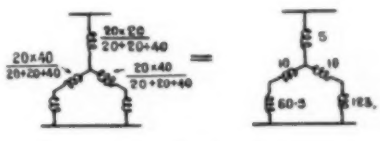


Fig. 17.

and reactance values must be multiplied by $(110/11)^2 = 100$.

We can now obtain the relative reactances of the step-down transformer at sub-station B and the local generators. The transformer initial short-circuit kVA $= 10{,}000 \times 100/8 = 125{,}000$ kVA, the initial short-circuit current (based on 110 kV) $= 125{,}000{,}000/110{,}000 \times \sqrt{3} = 656$ amperes, and the relative reactance per phase $= 110{,}000/656 \times \sqrt{3} = 97.0$ ohms.

The initial short-circuit kVA for the local generators $= 20{,}000 \times 100/10 = 200{,}000$ kVA, the initial short-circuit current $= 200{,}000{,}000/110{,}000 \times \sqrt{3} = 1{,}050$ amperes, and the relative reactance per phase $= 110{,}000/1{,}050 \times \sqrt{3} = 60.5$ ohms.

We can now prepare our impedance diagram for a fault on any portion of the 11,000-volt network. Fig. 13 represents an impedance diagram for calculating the short-circuit kVA to a fault on the local sub-station busbars. All values of resistance and reactance being relative to 110 kV, figs. 14 and 15 show the diagram, fig. 13, split up into the separate components of resistance and reactance respectively. It will be observed that the reactance diagram differs somewhat from the previous diagrams in that it includes an intermediate reactance connected horizontally across the chain, *i.e.*, the 40-ohm reactance. This form of diagram is the result of a ring-main system of interconnection, and such a system is chosen for this example in order to detail the manner of solving the diagram. It will be noted that three of the reactances form a delta connection, and in order to solve this diagram it is necessary to convert the delta to a star connection—a method of conversion as shown in fig. 16.

Dealing first with the resistance diagram, fig. 14, this can be solved readily as follows:—

$$[(40+80) \times 40/(40+80+40)] + 13.5 = 43.5 \text{ ohms.}$$

For the reactance diagram, fig. 15, we can convert into a delta connection, as shown in fig. 17, from which we get—

$$[70.5 \times 133/(70.5+133)] + 5 = 51.1 \text{ ohms.}$$

We have now obtained total relative resistance and reactance to a fault on the local sub-station busbars, and by adding vectorially as before we get:—Total impedance $= \sqrt{43.5^2 + 51.1^2} = 67$ ohms, and initial short-circuit current based on 110 kV $= 110{,}000/67 \times 1.73 =$ 950 A, and initial short-circuit kVA at local sub-station $= 950 \times \sqrt{3} \times 110{,}000 = 181{,}000$ kVA. This figure, although being the initial short-circuit kVA, will be the sustained value since, with the amount of external impedance, the decrement factor will be approximately 1.0.

Whilst all calculations have been made on a basis of 110 kV, the short-circuit kVA calculated is actual, and the actual short current per phase can be determined by dividing the short-circuit kVA by the actual voltage of the locality times root three. The foregoing calculations cover practically all conditions of interconnected systems, which at the present time are becoming numerous, and whilst they are somewhat involved, the writer is of opinion that the method employed is the only safe way of dealing with complicated systems. Furthermore, if impedance diagrams are prepared in the first instance, and all values are made relative to one chosen voltage, the calculated results should be very close to the actual condition in practice.

Our Foreign Electrical Trade.

Figures for 1925 and Previous Years Compared.

DETAILED statistics of the import and export trade of Great Britain in electrical machinery and apparatus, distinguishing the principal countries of origin and destination and the main groups of products, have now been issued for 1925, comparative figures being given as far back as 1921, except where the classification has been altered. Comparison with the period before April, 1923, is to some extent vitiated, because since then the trade of Great Britain and Northern Ireland with the Irish Free State has been included in the statistics, while the direct foreign trade of the Irish Free State has been excluded.

The aggregate imports of electrical machinery in 1925 varied but little in either value or weight from the average of the past four years. At the same time, the upward movement in exports, which started about 1920 and continued with only a slight setback in 1922 and 1923, was more than maintained; exports, in fact, are now more than two a half times greater in value and nearly three times greater in weight than they were in 1919. These broad and highly-satisfactory tendencies are discernible from fig. 1.

Of electrical machinery imports, the largest item specified, as in former years, is d.c. motors. The totals last year and in 1924 with the chief supplying countries are as follows:—

	1924.		1925.	
	Tons.	£	Tons.	£
Total	560	159,450	616	132,700
Inclu. from United States	216	107,650	198	68,900
,, ,, Germany ...	184	21,090	192	23,980
,, ,, Sweden ...	45	5,330	86	12,700
,, ,, Holland ...	9	3,960	40	7,650
,, ,, Belgium ...	16	2,700	47	6,330
,, ,, Switzerland	21	6,260	17	3,550

Imports of a.c. motors were rather greater in value, but less in weight, than in 1924, *viz.*, 550 tons (value £78,600), against 568 tons (value £74,400) in 1924. Of the 1925 total, £31,000 is credited to Sweden; £22,800 to the United States, and £9,600 to Germany—about the same as in the two preceding years.

No less than £711,000 (£100,000 more than in 1924) is given as the value of the imports of "electrical machinery not elsewhere specified." This seems a large proportion of unclassified plant out of a total of £1,085,000. More than a third of it came from the United States.

The export of traction motors will be seen from fig. 4 to be slightly below the 1924 level, but nothing approaching a set-back is apparent, and it still accounts for between 9 and 10 per cent. of the total value of our electrical machinery exports, whereas in 1919 the proportion was less than 5 per cent. There was a noteworthy increase, from £5,800 in 1924 to £22,700 in 1925, in the purchases of Canada, usually only a small buyer of such material in the British market. Other increases were:—Argentina £73,000 (compared with £23,000); India £55,000 (compared with £33,000); and Australia £102,000 (compared with £74,000).

Very healthy advances took place in the exports of other motors, both a.c. and d.c., those of the former amounting to 5,450 tons in weight and £807,000 in value in 1925, compared with 3,640 tons (value £568,900) in 1924; while exports of d.c. motors were 3,217 tons in weight and £552,000 in value in 1925, compared with 2,845 tons (value £499,800) in 1924.

It is noteworthy that the exports of a.c. motors in 1925 exceeded in weight even the "boom" year of 1921, while in value they were larger than in any year since then. Australia is credited with slightly over 25 per cent. of the total purchases (with £205,000), India, South Africa, and New Zealand being the next largest buyers. Japan appeared with £51,000, compared with an average of about £12,000 during the preceding four years, and Brazil with £48,600. In the d.c. motor trade the British Empire, as a whole, predominated, taking £435,000 out of £552,000. The Straits Settlements was a noticeably better customer in 1925.

It is interesting to note also who are our principal customers for generating plant:—

British exports.	A.C. Generators. Tons.		A.C. Generators. £	
	1924.	1925.	1924.	1925.
Total	4,671	2,661	707,800	405,000
Inclu. to South Africa	409	599	75,630	94,700
,, ,, India ...	521	414	79,160	63,000
,, ,, Australia ...	804	290	125,390	41,600
,, ,, New Zealand	354	80	52,316	10,620
,, ,, Japan ...	221	78	41,000	15,000
	D.C. Generators.			
Total	3,283	2,008	544,600	391,500
Inclu. to India ...	624	320	115,890	81,300
,, ,, Australia ...	493	289	104,380	60,000
,, ,, South Africa	1,078	64	131,100	22,500
,, ,, New Zealand	42	16	6,130	2,600

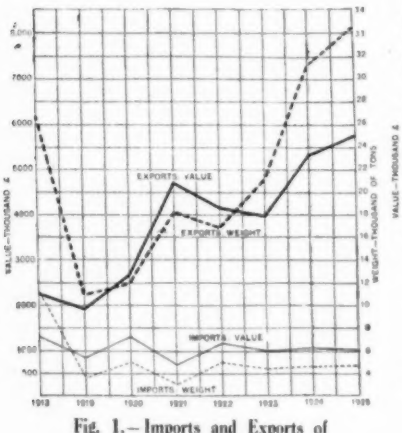


Fig. 1.—Imports and Exports of Electrical Machinery.

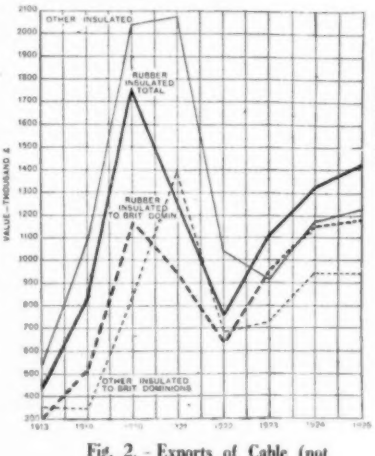


Fig. 2.—Exports of Cable (not Telegraph or Telephone).

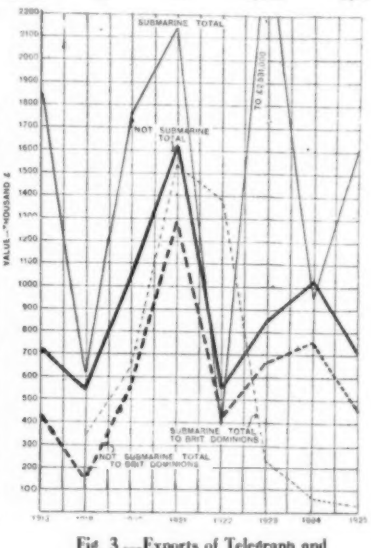


Fig. 3.—Exports of Telegraph and Telephone Cable.

Summarising the position of the electrical machinery trade, there is no cause for dissatisfaction. Imports have not increased to any material extent, while exports have gone ahead, particularly to Empire destinations.

The detailed statistics also allow an analysis to be made of the trade in the chief groups of electrical goods and apparatus, *e.g.*, telegraph and telephone material, cables, batteries, and accumulators, and lighting accessories. Figs. 2 and 3 show how exports in the cable group—which account for over one-third

of the total exports of electrical material other than machinery—continue to progress, although it is believed that our cable makers are not holding their former percentage of the world's total orders. Trade in 1925 in submarine cables is weighted by the large sum of £867,000, representing exports to Italy and accounting for more than half the shipments to all destinations during that year. To British countries there have been no exports of such magnitude since the large item of £829,000 for India in 1921.

No exact comparison can be made with previous years in the case of the trade in telegraph and telephone instruments and apparatus, the classification having been altered and new headings raised in respect of radio material. The exports of radio material (not including valves) reached the large total of £1,106,000 in 1925, the main destinations of this comparatively recent branch of activity being:—British countries, £409,000 (including Australia £149,000, India £48,000, South Africa £42,000, and Irish Free State £73,000), and foreign countries £697,000 (including Japan £180,000, United States £53,000, France £35,000, and Brazil £21,000). Japan and Australia were very valuable customers also for other telegraph and telephone instruments. The separate heading raised for the export of radio valves reveals that this branch is also growing into a very healthy business. Shipments totalled £183,000 in value in 1925, divided more or less equally between British and foreign countries, with Australia the best customer (£51,000), then Japan (£42,000), Sweden (£12,000), South Africa (£10,500), and Canada (£10,000). That there has been a substantial advance in this trade is evidenced by the fact that in 1923 the combined exports of the group comprising vacuum tubes, X-ray tubes, and radio valves were only £85,000 in value.

In the lamp trade the balance is still in our favour, but in 1925 imports showed a larger increase on 1924 than exports. The variations in this trade in recent years are plotted in fig. 4. Among supplying countries Holland well maintains her leading position. At the same time, Austria is making great progress. Fig. 5 shows the relative position of the total import and export trade in electrical goods and apparatus in 1913 and since the war (omitting 1914-1918 as being abnormal years), together with the proportion of exports which has gone to British countries.

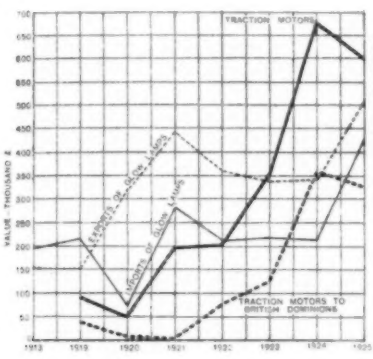


Fig. 4.—Exports of Glow Lamps and Traction Motors.

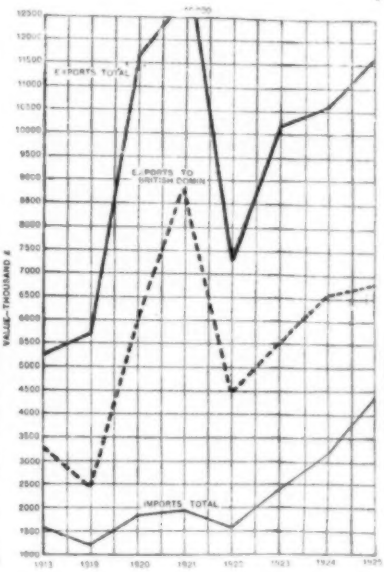


Fig. 5.—Imports and Exports of Electrical Goods and Apparatus.

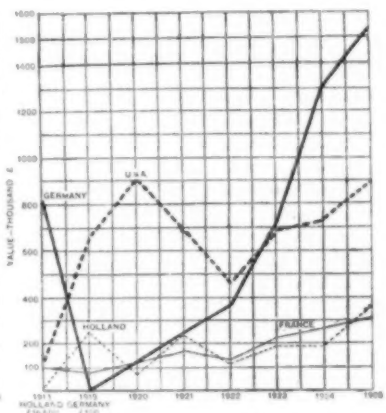


Fig. 6.—Origin of Imported Electrical Goods and Apparatus.

The next point of interest is the various countries supplying our imports of electrical goods and apparatus and how their respective shares have varied in recent years. In order to illustrate this point, figs. 6 and 7 show the values of the imports (retained for consumption) of this group, in recent years and in 1913, from the principal countries of origin. It is significant that Germany's share increased further in 1925, *i.e.*, to £1,542,600, against £1,296,000 in 1924, while that of Austria is steadily advancing, her share in 1925 being £212,000. The rise in the grand total from all countries is spread over nearly all the principal groups.

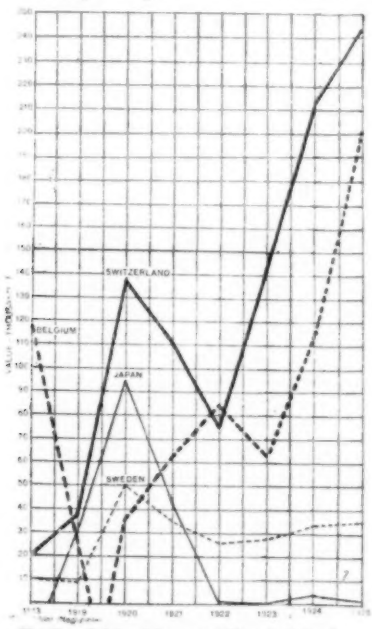


Fig. 7.—Origin of Imported Electrical Goods and Apparatus.

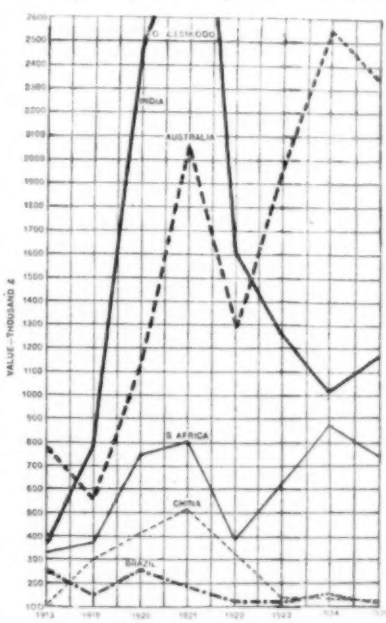


Fig. 8.—Destinations of Exported Electrical Goods and Apparatus.

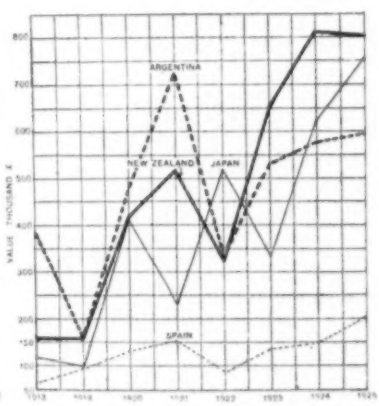


Fig. 9.—Destinations of Exported Electrical Goods and Apparatus.

Imports of radio instruments and apparatus (except valves) show the considerable total of £654,000, more than half being supplied by Germany, while those of valves totalled £134,000 in value, Holland being the

largest supplier. Comparing these figures with the export statistics, it will be noticed, however, that in the radio trade the balance is still largely in our favour. In the import trade in batteries Germany has further strengthened her position.

In conclusion, figs. 8 and 9 show graphically the progress of our export trade in electrical goods and apparatus with the principal consuming markets. Chile is another promising outlet (not shown in our charts), although during the past three years our exports to that country have "marked time" at round about £100,000 in value. Our interest in the markets of Peru and Uruguay seems to be declining. It should be added that exports to the Irish Free State in 1925 were well maintained, *viz.*, at £376,500, compared with £378,500 in 1924. Another large total, not shown in the charts, is that representing Italy's total purchases of British electrical material other than machinery, viz., £933,000, this figure being swollen by the large import of submarine cable to which reference has already been made.

Publicity in Rural Areas.

By EDWARD E. HAMAR (the Shropshire, Worcestershire, and Staffordshire Electric Power Company).

PUBLICITY is of quite as much importance to an electric supply undertaking as to a manufacturer, but the "hitting the nail" form of publicity is, to my mind, not quite what may be desired.

The publicity matter generally distributed is still far too technical for the lay mind, if I may be allowed to speak from knowledge obtained from the area in which I am particularly interested. Unless publicity is in simple language it becomes nothing more than so much extra burden for the postmen to carry and deliver, and, in turn, for the dustman to dispose of.

I have found in my experience that there are still many people who are not aware that electrical service, apart from lighting, will perform such duties as ironing, heating, and cooking, and among those who are aware, the general feeling is that such appliances are ideal, and can only be enjoyed by the wealthy. Such thoughts must be banished. May I give a brief outline of what I consider to be the better way of reaching the public?

My remarks are largely confined to development in rural areas. In our cities and towns, a central showroom where periodical demonstrations and displays are given, and the occasional circulation of seasonable and simple publicity matter, together with canvassing, are undoubtedly of much value in obtaining new business; but when it comes to the truly rural areas, the proposition requires quite special consideration.

It is generally found that rural dwellers, and more especially the farming fraternity, are particularly keen; for such, publicity in its existing form is not of much use, and the only way to convince is by practical demonstration.

Valuable pioneer publicity work can be accomplished with a portable kinema apparatus, and a display of suitable films given in the village hall or school undoubtedly appeals, especially if the advertising is not overdone; that is, the programme should include one good travel picture and a "comic," the latter being of advertising value, but really amusing.

The kinema display should be followed by a demonstrative exhibition of a simple character, arranged in the village hall or school, demonstrating lighting, washing, ironing, vacuum sweeping, cooking, heating, &c., and exhibiting only one of each appliance, taking in turn the products of the recognised manufacturers of such apparatus.

The type of individual required to canvass for domestic business should be a man not too far gone—that is, not too technical. I have found that it is far better to draw a canvasser from the commercial side of the undertaking who has some slight engineering knowledge, than to have an entirely technical engineer. A man with good commercial training will undoubtedly get the domestic business more speedily than the more technical man. A prospective consumer does not want to hear about volts, amperes, watts, and units; it is the cost of operation in pence that he is interested in, and this is where the commercial man will score.

A good idea for either a showroom or an exhibition is to have a special ampere-hour-meter, with, say, a 12-in. circular dial graduated in ⅛d., giving the prospective consumer just the information required.

The many electrical appliances should be advertised, exhibited, and demonstrated in their appropriate season, and in the showroom window a special tableau can be arranged with scenic effect, representing the surroundings under which the particular appliance will operate, for "stunts" draw the public when a conglomeration of fittings, &c., is not an attraction. Just feature one appliance weekly, with the cost of operation per hour given very clearly in pence! If it costs ½d. to boil three pints of water in an electric kettle at a certain price per unit, say so, for even if it is considered high in the first place, truthful statements score in the end. We have nothing to hide, for electricity can compare favourably with other methods and show advantages in efficiency and cleanliness.

The average farmer is certainly a keen-sighted man, possessing business acumen which compares well with that of the citizen, and is often in advance of it. Here, again, the only way to convince him of the advantages attending electrical service in agriculture is by practical demonstration.

The type of individual to employ for canvassing farmers should, if possible, be a man drawn from the farming fraternity, that is, one who in his early days has spent some time on a farm, and later has taken up commercial and electrical engineering as a profession.

To make a good canvasser it is absolutely essential to have just sufficient knowledge of a client's business to be able to claim the interest and attention necessary in the leading-up conversation.

Market days are all-important days in the life of the rural canvasser, for by attending the markets he can obtain introductions and do much useful work in giving preliminary information bearing upon prospective business.

For demonstration purposes it is a good proposition to select an average class farm and obtain permission to equip it throughout with electrical appliances for both the farmhouse and the buildings, the installation to be the property of the supply company, and to be available for inspection and demonstration at mutually agreed times, or by special invitation. This arrangement is, as a rule, much appreciated by an enterprising farmer, and for the concession special terms for electricity supplied can be arranged.

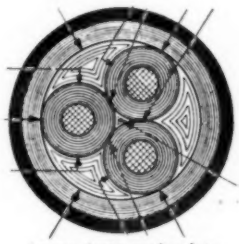
The revenue attending rural development is at the moment extremely small, and in order to place such developments on an improved commercial basis it is, in the first place, absolutely essential that, as far as possible, overhead distribution shall be adopted, and secondly, that business apart from lighting (such as cooking, heating, and power) be obtained.

The dweller in rural areas welcomes electric service for lighting, but he has to be convinced and educated in the many other uses, and it remains for those responsible to grasp the situation and push on, overcoming the many rebuffs that are met, with that courtesy and pleasing manner which every canvasser should possess.

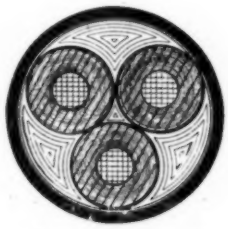
A High-Pressure Cable Development.

The "Hochstadter" System.

EXPERIENCE in the use of three-core underground cables of the ordinary belted type on pressures above 10,000 V has shown that the dielectric of such cables is submitted to stresses exceeding those to which the dielectric of a single-core cable is subjected, and the many advantages of the three-core cable in other directions have led to world-wide research on the question. One important result has been the development of the "Hochstadter" or "H" cable. In 1914 a patent was granted to M. Hochstadter for a practical means of reducing the multi-core cable stresses to those appertaining to the



Arrows denote weak points.
Fig. 1.—Belted Cable.



Shading indicates stress areas.
Fig. 2.—"H" Cable.

single-conductor cable, and in 1916 that gentleman published proofs that his patent was based on a correct theory of the stresses to be overcome, and claimed to have successfully eliminated them.

The development of the "H" cable in this country is of particular interest, and we understand that the Macintosh Cable Co., Ltd., after having made a thorough practical

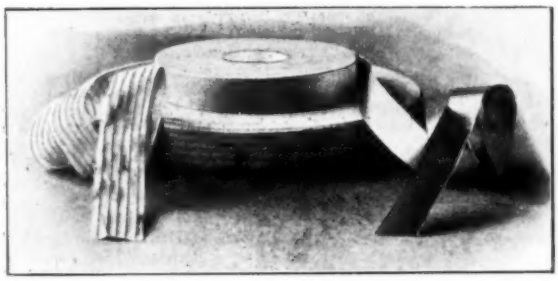


Fig 3.—Conducting Media.

investigation of the claims, is now manufacturing the new cable, and has been favoured with the first order placed for its manufacture and use in Great Britain.

The details of the pioneer work will no doubt be of interest to our readers, and it is therefore proposed to briefly describe the cable, its process of manufacture, and the practical tests to which it was subjected before the makers decided to produce it in quantity for general use.

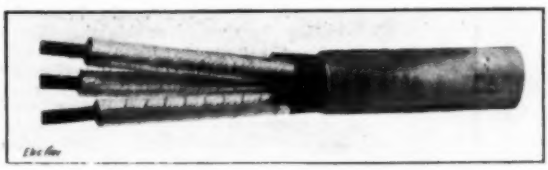


Fig. 4.—Construction of "H" Cable.

The problem being to eliminate the excessive dielectric stresses which exist in ordinary three-core cable where the surfaces of the insulation of the cores touch each other or the belt insulation, fig. 1, it would be thought that by lead-covering the insulated cores and treating them as separate cables, and dispensing with the belt insulation, a satisfactory solution would be found, but apart from the increased weight and cost of the cable, the lead covering has serious disadvantages incidental to the manufacturing processes. In order to avoid these difficulties it was found desirable that the conducting medium should be served on to the cores by a similar process, and at the same time as the insulating material, and this is the interesting feature in the construction of the "Hochstadter" cable, in which the conducting medium is in the form of metallised tape, fig. 3, the top coil being the metallised paper tape used round the individual cores, and the lower coil a cotton tape interwoven with thin copper strands which surrounds the conductors in the same way as the belt insulation of the ordinary cable.

The resultant product is illustrated in fig. 4; the metallised core coverings are in intimate contact with each other and the copper wires of the surrounding tape, which again makes contact with the lead covering. The intimacy of the contact of these coverings, it is claimed, is assured by their flexible nature, which results, with the filling, in a homogeneous mass in which no air or gas pockets can be formed during the process of construction, a feature of supreme importance when the

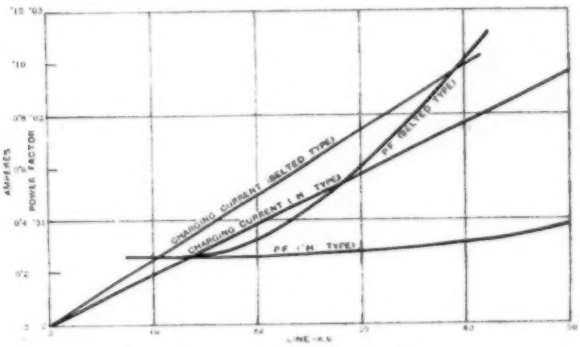
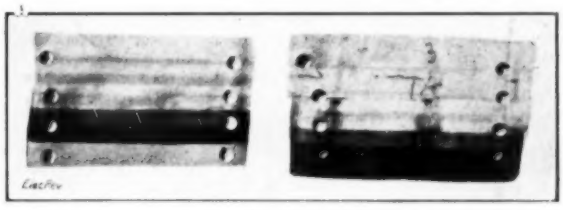


Fig. 5.—Dielectric Leakage and P.F. Curves.

deleterious effects of ionisation are borne in mind. Further, the solid mass resulting from this construction has no tendency to separate at any point.

The dielectric stresses are thus confined to the shaded areas, fig. 2, where they do not exceed those which exist in any single-core cable working at the same pressure.

To obtain a practical comparison betwen cable constructed in this manner and the existing belted cable, a length of each type was constructed, and these were then tested under identical conditions. The marked superiority of the "H" cable, both as regards dielectric power factor and loss, is shown in fig. 5. Pieces were then cut out from each length and subjected to the B.E.S.A. bending test, and although the rough handling and absence of mechanical armouring nearly caused the lead sheath to burst in places, the application of 100,000 V for several hours failed to break down either type of cable. The pieces were then opened up and every



Figs. 6 and 7.—"H" and Belted Cable Papers, after Tests.

layer of paper was carefully examined. Figs. 6 and 7 show, respectively, typical examples of the papers from the "H" and ordinary cables. While in the former no trace of "charring" or "treeing" is seen, in the latter there is distinct evidence which extended throughout the whole of the piece down to the eleventh layer, and there is no doubt that if the electrical pressure had been applied for a longer time the belted cable would have broken down, as a noticeable rise in temperature in this had taken place. The test was discontinued after eight hours because of this rise in temperature, and in previous tests the belted cable had broken down in under 12 hours, whereas the "H" cable had never broken down under these conditions.

The reduction of temperature rise due to dielectric losses naturally permits the new cable to be loaded higher than the ordinary cable, and experience gained on the Continent, and corroborated by the Macintosh Cable Co., puts the increase at from 14 to 21 per cent.

It is interesting to note that about 400 miles of "H" cable is at present in use in various parts of the world on pressures up to 60 kV, and in sizes varying from .03 sq. in. to .5 sq. in.

The Institution of Fuel Technology.

Proceedings at its First Autumn Meeting.

THE newly-formed Institution of Fuel Technology held its autumn meeting—the first meeting it has arranged for the discussion of technical problems since its formation—at the Institution of Mechanical Engineers, Westminster, on December 7th and 8th, under the presidency of Sir Alfred Mond, Bt., P.C., M.P.

Presidential Address.

In the course of his presidential address, Sir ALFRED referred to the progress made towards the merging of the Institution of Fuel Technology and the Institution of Fuel Economy Engineers. For some months, he said, it had been felt by those most closely associated with problems of fuel economy, and by those who had a general interest in the question, that the two bodies should be merged into one. After various discussions as to the conditions of fusion, he had taken it upon himself, as president of both bodies, to put forward concrete proposals. They included the suggestion that a new title for the combined Institution should be adopted by a joint Council of the two existing Institutions; that the membership of the new Institution should be of four classes, including a class of Fellows, to be limited at the discretion of the new Council to be appointed; and that the new Council should, in the first instance, be determined by a joint meeting of the president, vice-presidents, and chairmen of both Institutions. These proposals had been accepted in principle by the Councils of the two existing bodies; the whole problem had been approached in a spirit of goodwill, and it now but awaited formal ratification to be given to the formation, upon a mutually satisfactory basis, of one great and powerful united organisation.

The recommendation of the Coal Commission that a National Fuel and Power Committee should be established was carried out by the Board of Trade last August, with Sir Alfred Mond as chairman, and one meeting had been held. He reviewed at some length the work of some of the committees and commissions which had already conducted inquiries into the use of fuel and the production of power, from 1901 onwards, and pointed out the necessity of preventing the enormous amount of overlapping of research that was taking place. He divided the main problems of fuel technology under three heads:—(1) Fuel economy to be obtained from existing plant now in actual operation; (2) fuel economy resulting from the development of the use of electricity; (3) future development of fuels—such as new uses and treatments of coal, oil, and the elements. These seemed to be the three directions in which the Fuel and Power Committee could most usefully conduct its inquiries and offer advice to the Government. These were also the directions in which that Institution could most fruitfully assist the Committee, the various industries and interests which it represented, and also the community at large.

After discussing the domestic and industrial aspects of the subject, Sir ALFRED referred to the ignorance met with in many works with regard to the cost and efficiency of their use of fuel, emphasising the importance of buying coal on heat value, and pointing out that the production of power was in many cases a minor use of fuel. He severely criticised the methods of accountancy in vogue, which hampered the progress of industry, and the mistaken view that research should be paid for out of profits, whereas it really represented capital expenditure.

Turning to the economy of fuel resulting from the use of electricity, Sir ALFRED discussed the question of private generation, as compared with public supply, the choice, in his view, depending entirely on local conditions. He considered that the electric furnace was likely to be more widely used in industry, and that electric heating would develop when the price of electricity was reduced. The alleged cheapness of water power, he said, in many cases proved to be illusory, when account was taken of the capital charges; electricity could be produced as cheaply by steam at Buffalo as by water at Niagara.

Among the papers read and discussed during the course of the meeting was the following:—

The Occurrence, Working and Treatment of Brown Coal, with Special Reference to German Practice.

Sir RICHARD REDMAYNE'S paper gave a very full account of the occurrence of brown coal or lignite in various parts of the world, the methods adopted for working it in Central Germany, and the uses to which it is put. Vast deposits of lignite exist in the British Empire; the term denotes those solid fuels which are geologically young, which have retained their wooden structure, and which have the appearance of decayed wood. The fuel mined in Germany under the name of "brown coal" has no woody structure; where the deposits are hard the fuel is mined in lumps resembling chocolate, and where they are soft it is like spoiled snuff. Its composition varies very widely in different places. The total of the world's available resources has been estimated at three million million tons. The deposits in the Latrobe Valley, Victoria, Australia, are most remarkable, aggregating 781 ft. in thickness, and at least 31,000,000,000 tons in weight. Some of the best brown coals occur in New Zealand, and Canada possesses enormous reserves.

Owing largely to the loss of the Upper Silesian coal field and of the Sarre coal field, the brown coal industry of Germany has greatly developed since the war; the chief consumer is the electric power industry. In 1913 brown coal was the source of only 23 per cent. of the electric power generated; but in 1922, 41.2 per cent. The generation of electric power in Germany more than trebled in the ten-year period 1913-1922; thus there were produced 2.2 thousand million kWh in 1913, as against 7.2 thousand millions in 1922. Hydro-electric power accounted for part of this increase, from 11.6 per cent. of the total in 1913 to 14 per cent. in 1922. With the concentration of electricity production in large power plant, built within the last 10 years, a saving of from 15 to 20 per cent. in coal has been effected. The increased use of brown coal has resulted in a reduction of the proportion of electricity generated by true coal from 63.3 per cent. in 1913, to 48.3 per cent. in 1922. The working of the deposits is described very fully, with many illustrations.

Discussion.

Sir WILLIAM LARKE referred to the burning of raw brown coal or lignite at the electric power station at the Fortuna mine, near Cologne. When he visited it some years ago the raw lignite was conveyed from the mine by six lines of endless chains hauling up trucks, each of which held about one cubic yard, which automatically tipped their contents into the bunkers at the station. The grates were specially designed; they had an inclination of about 60 deg., and were practically self-cleaning, and it was necessary to remove the ash only once in the eight-hour shift. The grate area was seven times greater than would be required if bituminous coal were used. The lignite was used successfully, however, in spite of its large water content.

Sir PHILIP DAWSON said that there were three great brown-coal fields in Germany where electricity was being produced directly from brown coal burned under boilers, and he believed that 40 per cent. of the electricity produced in Germany was generated in that way. Electricity was produced at a very low rate and transmitted over long distances. Brown coal was also used largely in three large stations in Saxony, one owned by the Saxon Government and the other two by private companies, a large proportion of whose shares were held by the Prussian Government. They were transmitting something like 100,000 kW a distance of a little over 100 miles to Berlin, and were connected up to the new supply station there, which eventually would have a capacity of 500,000 kW. The first half of that station was now nearing completion. The utilisation of inferior fuel and the erection of works near such fuel beds might be adopted in this country. Near our coalfields there were vast dumps of very low-quality coal, so poor that in many cases it was not worth bringing to the surface, except to enable the better coal to be mined. During the coal strike that material had been burned in comparatively large quantities by the Birmingham Corporation and the results achieved were extraordinary. It might be an advantage to erect stations on the coalfields and to use cooling towers; although that might result in a slight decrease in the efficiency of production, that decrease would be more than counterbalanced by the very low rate at which the coal would be procured. Although the calorific value of that coal was low, it was certainly much higher than the calorific value of the brown coal used so largely in Germany, and it contained a lower percentage of moisture than the brown coal. The coal might be used in the powdered form, because that would enable the different grades to be used without the necessity for a special grate area or a special arrangement inside the combustion chambers of the boilers. That was an extremely interesting proposition, and one which he believed would develop very largely in this country, in view of the fact that the Germans had found it to be good business to install their power stations directly on the brown-coal fields, notwithstanding the lack of supplies of condensing water. Urging the need for the distillation of low-grade coals, he said that there were millions of tons of cannel coal dumped around the Scottish mines, and analyses which he had had made of samples taken at random showed that they contained anything from 20 to 30 gallons of oil per ton. At present, this fuel could be had for the asking, but once low-temperature carbonisation and distillation was developed that would no longer be the case; therefore, arrangements should be made now to control these things if they were to be efficiently and effectively used. Another interesting fact was that in Scotland the cannel coal occurred in layers in the black coal, and in some cases it did not pay to extract the black coal because it was necessary to extract the cannel at the same time, and the cost of

that had to be added to the cost of extracting the black coal. The cannel coal, as extracted directly from the mine, contained 60 gallons of oil per ton, so that it was eminently suitable for distillation, and did not present the difficulties encountered in connection with various classes of oil shale, particularly those found in Esthonia and some of the other Balkan States. A plant was ready to be put into action in Scotland for the utilisation of these materials in the production of oil and gas, the latter having a high calorific value, and arrangements had been made with neighbouring gas companies whereby this gas, which otherwise would be difficult to dispose of, would be pumped directly into the mains of the gas companies—who would be able to shut down their producing plants—at a rate which would be remunerative to the producers, and which would be below that at which the gas companies could manufacture gas themselves. Plants of a similar kind were also being erected in England. One of the mistakes that they in this country had made in the past in connection with so-called low-temperature carbonisation was that the work had been done more or less as a Stock Exchange gamble; companies had been floated and had proved disastrous to the shareholders, not because the system of carbonisation itself was faulty, but because enormous installations had been put up before practical experience had demonstrated their suitability for the purpose. In Germany methods were quite different. The owners of large iron and steel works and collieries, such as Thyssen's and Krupp's, had spent large sums of money in erecting plants and obtaining practical experience with them, with the result that they had achieved success in the distillation of brown coal, and the distillation of black coal was also being adopted on a very considerable scale. We in this country should adopt similar methods, and it was essential that our large industrial concerns should find the necessary money for experiments on a practical scale, so that there would be some certainty as to the results which would be achieved when the industrial plants were erected. His study of low-temperature carbonisation had led him to believe that it was of the greatest importance to our future, because it would enable coal to be utilised more efficiently.

Mr. HAROLD NIELSEN, dealing with the brown coal deposits in the Latrobe Valley, in Victoria, Australia, extending over an area 50 miles in length, said the thickness of coal, which was referred to by Sir Richard Redmayne as being 781 ft., was confined to an extraordinary natural basin, known as Maryvale-Morwell, where, within an area of 3 sq. miles, no less than 1,500,000,000 tons of coal had been proved to exist. In one block of 430 acres, bores were put down under Government supervision to 1,019 ft., and huge seams of coal had been discovered, one of which had a gross thickness of 439 ft. The moisture contents, as calculated by the official analyst to the Victorian Government, averaged about 30 per cent. His own experiments, however, had indicated a moisture content of from 35 to 40 per cent. Owing to the presence of clay strata above and below the seams of coal, the moisture content was far below that of the lignites of Germany. The Morwell type possessed an ash content of only 3 per cent., and was practically free from sulphur. Brown coal was peculiarly suitable for oil distillation and subsequent pulverisation. Altogether, this colossal deposit of admirable fuel, readily accessible in British Dominions, might well be acclaimed a great Empire asset.

Mr. CHARLES ERITH, after quoting figures to show the wide variations which existed between fuels of undoubtedly the same lignitic character, said it was often found to be more economical to burn bituminous coal for the production of electricity at or near the point at which it was to be used than to generate at a distance with cheap fuel and pay transmission costs. Referring to the utilisation by the Birmingham Corporation of the coal in the pit dumps, he said he did not think it would be worth while to continue to do that now that ordinary coal was available, because he understood that when using the coal from the pit dumps the efficiency of the plant was only 60 per cent., whereas with ordinary fuel it was 75 or 80 per cent.

Dr. A. H. RAILING (Birmingham) said there was no doubt that the Birmingham Corporation plant, and a good many of the works in the Birmingham district, had been kept going with pit-mound material. Roughly speaking, four parts of the pit-mound material were combined with about one part of slacks, with satisfactory results. Whether it would pay the Birmingham Corporation to continue to use pit-mound material depended largely upon the cost of transport of coal. With regard to generating stations at the pit mouths, he said they were too apt to think of coal on the one hand and electricity on the other, instead of thinking more in terms of energy. We had cheap energy in the form of pit-mound material at a certain place, and we required electrical energy somewhere else. We had to consider each case on its merits—whether it would pay better to transport that fuel to a site at which it could be transformed into electrical energy by the most efficient methods, *i.e.*, by using condensing plant, and then transmit the electrical energy to the point at which it was to be used, or whether it would pay better to suffer the disadvantages of using non-condensing plant but to save the cost of transporting the coal and perhaps reduce the costs of transmission of electrical energy.

Dr. DVORKOVITZ did not think that the use of briquettes made from raw lignite would be a paying proposition, because of their tendency to fall to pieces. Moreover, at a temperature round about 180 or 200 deg., they gave rise to spontaneous combustion.

The Inaugural Dinner.

THE inaugural dinner of the Institution of Fuel Technology was held at the Hotel Cecil, London, on December 7th, when some 200 members and guests were present. The Rt. Hon. Sir Alfred Mond, Bt., M.P., president of the Institution, was in the chair at the function, and, after the loyal toast, "The Institution of Fuel Technology" was proposed by the Rt. Hon. Col. LANE-FOX, M.P., J.P. He said that the public were hoping that the new institution would be able to give them a smokeless atmosphere and render the country independent with regard to its oil supplies. Vast sums of money had been wasted on the premature development of fuel-economy schemes. What was wanted was the proper co-ordination of the nation's knowledge which, it was hoped, the Institution would bring about; it was the first occasion that such co-ordination had been attempted. Now that the industrial war was over, let science come in and help to solve the difficult coal problems of the country.

In reply, Sir ALFRED MOND reminded the company that coal was only one form of fuel, and that it was necessary to take a wider view and consider oil. One of the problems which the Institution had to solve was an alternative to the present primitive method of using the carbon in our fuel. If the third of the country's coal output which was at present being sold at a loss could be made profitable to produce, then a great service would be done to the industry and to the country. High coal prices were not generally the result of profiteering, but of wasteful distribution. There were many divergent views on the fuel-treatment problem, but whether coal was electrified or gasified, one or more of the suggested processes would certainly in time be adopted. In Germany low-temperature carbonisation was becoming established, and in America the coke ovens were used extensively. He was certain that in the future electricity would be used in the home in this country to the same extent that it was in America. On a washing day in Toronto 10,000 h.p. was used in electric washing machines and irons. Electric cooking was also popular. Where cleanliness and convenience prevailed, the cost difficulty vanished. He hoped the public did not expect the Electricity (Supply) Bill to produce a new heaven and earth. Whatever happened, electric supply stations ought not to be antagonistic to one another. The Institution aimed at the exchange of ideas which should produce great results. The day was past when it was usual to sit on a new idea like a broody hen. The economical use of the fuel of this country was the basis of industrial economy.

Sir WILLIAM J. LARKE, K.B.E., chairman of the Council of the Institution, proposed "The Guests," coupled with the name of Dr. Eccles, F.R.S., president of the Institution of Electrical Engineers. He welcomed the various Government officials who were present and the presidents of the great institutions of the country. In the presence of the latter the new Institution was conscious of its youth, and entered the field with modesty, but it was inspired sufficiently to have ambition to emulate the work of the great Institutions. Referring to the I.E.E., he said that the electrical industry had the closest relation to the investigation of fuel, and it was the first to have adequate measurement of the power it was using. He was pleased to be able to say that an arrangement had been made for the amalgamation of the two Institutions concerned with fuel economy.

Dr. ECCLES, in reply, said that the electrical engineer in this country had the closest relation with fuel economy. We had not the advantages of other countries in regard to power sources other than fuel; therefore fuel technology was of paramount importance in the electrical industry.

Sir PHILIP DAWSON, M.P., proposed "The Chairman," and paid a great tribute to Sir Alfred Mond, under whose presidency, he said, the future of the Institution was assured. The unification of the two fuel concerns, referred to by Sir Wm. Larke, was the result of the work of Sir Alfred, and was one example of his untiring energy and influence.

The proceedings concluded with a suitable reply by the chairman.

British Cast-Iron Research Association.—We have received a copy of the fifth annual report, for the year ended June 30th, 1926, of the above Association. It is recorded that the year under review was by far the most important in the development of the Association; during that period an amalgamation was effected with the Falkirk Technical Institute, which is now the Association's Scottish laboratory, and a Scottish Committee was formed to guide this new activity. The laboratory will be largely concerned with developments in connection with the light-castings industry. The offices and English laboratory are now incorporated in one building, at 24, St. Paul's Square, Birmingham. The total subscribing membership of the Association at the end of the year in question was 284, as compared with 275 at the end of the previous year. At the annual meeting held in November the president, Sir John Dewrance, K.B.E., was re-elected. The total income for the year was £8,460, as compared with £6,186 for the previous year, and the total subscription income for the five-year period now exceeds the £12,500 stipulated by the Department of Scientific and Industrial Research, as a qualification for a grant. The expenditure for the year amounted to £8,811, as compared with £5,698 for the previous year.

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The Radio Manufacturers' Association.

First Annual Meeting.

THE inaugural meeting of the Radio Manufacturers' Association was held in London on December 8th. Mr. Bowyer-Lowe, chairman of the Interim Working Committee, presided, and presented his Committee's report. The names of the firms who had joined the Association were read out—43 in all.

The Committee's report stated that negotiations with the trustees of the N.A.R.M.A.T. had been brought to a successful conclusion. The Retailers' Section of the latter Association was being given an *ex gratia* grant of £400 to enable it to form a new Retailers' Association. The R.M.A. started its career well equipped and in a favourable financial position. Application had been made for registration as a trade union, which had that day been granted. The New Hall, Olympia, had been booked for an exhibition from September 21st to October 2nd, 1927, and negotiations were proceeding for similar periods in the four succeeding years. The Association had asked the new British Broadcasting Corporation for representation upon the advisory committees which were being set up, and nominations had been made to expedite matters. Representatives had been appointed to serve upon the B.E.S.A. Committee for the standardisation of valve holders, and upon the I.E.E. Committee dealing with the issue of wiring regulations for battery eliminators in connection with the h.t. supply to receiving sets. With regard to offices and staff, the Committee retained the N.A.R.M.A.T. offices and secretariat pending transfer to the R.M.A. or the making of other arrangements. The appointment of paid officials would be one of the first duties of the Executive Council to be elected at that meeting. The Committee made certain suggestions with regard to the election of the Council.

Col. ERIC BALL seconded the adoption of the report, which was carried unanimously. A vote of thanks was accorded the Committee upon the proposition of Mr. W. W. Burnham, seconded by Mr. J. Joseph. At the request of the chairman, it was agreed that the election of a president and vice-president should be deferred. Mr. BOWYER-LOWE said that a number of prominent gentlemen had been approached, but nothing had been definitely settled.

The result of the ballot was announced; the following firms were given the right to nominate one representative each:—The Bowyer-Lowe Co., Ltd.; Messrs. Brandes, Ltd.; the Brownie Wireless Co. of Great Britain, Ltd.; Burndept Wireless, Ltd.; the Dubilier Condenser Co. (1925), Ltd.; Graham Amplion, Ltd.; the Igranic Electric Co., Ltd.; Messrs. L. McMichael, Ltd.; Metro-Vick Supplies, Ltd.; the Mullard Radio Valve Co., Ltd.; Radio Instruments, Ltd.; and the Climax Radio Electric, Ltd.

In reply to a question, the chairman said that the Association was in a position to put a "stop list" into operation immediately. It was agreed that the Association should support the proposed Wireless Section of the London Chamber of Commerce.

The meeting concluded with a vote of thanks to the chairman.

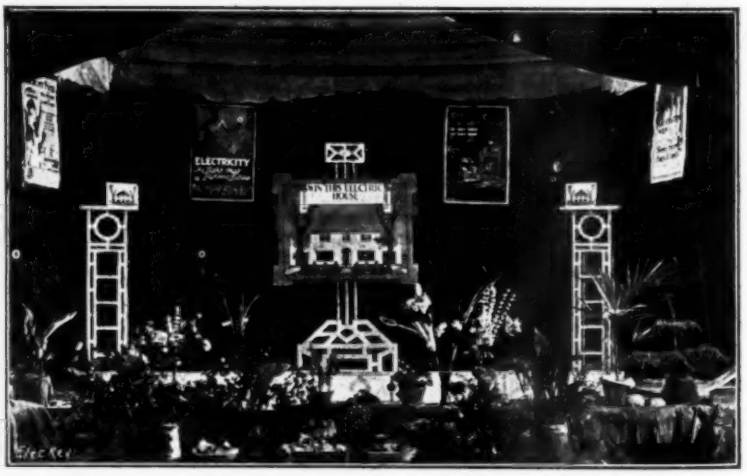
Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The Christmas Holidays.—Owing to the Christmas holidays, our issue of December 24th will appear one day in advance of the usual time. Therefore it will be necessary for all editorial and advertising matter to be in our hands early. Our Advertisement Department notifies that Monday next (December 20th) will be the latest time for the acceptance of Official Notices, Situations Vacant, &c.

Art in Publicity.—In the preparation of their new season's radio catalogue, Messrs. WARD & GOLDSTONE, LTD., broke away from their usual practice of commissioning an artist to design the front cover. Instead they gave an opportunity to the students at the Southport Victoria School of Art to produce a suitable design, and offered prizes for the best two. The result was satisfactory from the company's point of view, and a number of designs were submitted. The one selected as first in order of merit is reproduced herewith. It suggests in an admirable way the spirit of radio.

A Winning Radio Catalogue Design.



A Display by the Shropshire, &c., Power Co.

The E.D.A.-E.L.M.A. Campaign.—The official report for the week ended December 11th says that additional circles were formed at the following places (the chairmen's names being given in parentheses):—Lichfield (Mr. Morrison), Exeter (Mr. H. D. Munro), Weymouth (Mr. G. Nicholson), Folkestone (Mr. Bennett), Stepney (Mr. W. C. P. Tapper), Woolwich (Mr. G. Keats), and Blyth, Northumberland (Mr. J. Hibbert-Smith). There are now 93 circles, of which 20 are in the North-East Coast area. Four electric demonstration homes were opened during the week—two at Nottingham and one each at Harrogate and Wakefield. Offers have been received for three more houses in Manchester. The attendance at the Leeds house is said to be 300 per day, admission being by ticket only. 9,700 people (about 10 per cent. of the population) visited the Halifax house during the first ten days. Messrs. Baileys, electrical engineers, Seven Dials, Brighton, have a demonstration house which can be inspected by appointment. Up to date 32 electric demonstration houses have been opened in connection with the campaign. An increase in the demand for booklets is said to have resulted from the new form of advertising, and there have been considerably increased sales of "literature," kinema lantern slides, and model houses. A meeting of supply engineers in the London and Home Counties area was held at the London Lighting Service Bureau on December 10th.

As we have already stated, the Shropshire, Worcestershire and Staffordshire Electric Power Co. is doing a great deal to further the campaign in its area of supply, mainly by the holding of exhibitions in its various districts. The accompanying picture illustrates a recent display arranged by the company. It will be seen that the prize-house poster and other E.D.A. productions are given great prominence.

At Harrogate last week a well-equipped electrical demonstration house was opened to the public, and it will remain open until Christmas Eve. It has been organised by the Corporation Electricity Department and 13 local firms of contractors. A pamphlet has been issued illustrating and describing the dwelling, and from this we gather that the furniture, carpets, curtains &c., have been provided by Messrs. Charles Walker & Co., Ltd., and that the following companies have been responsible for the electrical appliances:—The General

Electric Co., Ltd., the British Electric Transformer Co., Ltd., Metro-Vick Supplies, Ltd., and the Edison Swan Electric Co., Ltd. The decorations were carried out by Messrs. Topham Bros., Ltd. The low charges for Harrogate electricity are emphasised in the pamphlet, *viz.*, 4d. per kWh for lighting and ½d. per kWh for heating; a rateable value system is available. Cooking and vacuum cleaning are being demonstrated daily.

The Hampstead electrical circle is organising an electrical exhibition in connection with the campaign, at Lithos Road, Finchley Road, N.W.3, in a building lent by the Hampstead Borough Council, to take place from January 22nd to 29th. Applications for space should be made immediately to Mr. M. Watson, hon. secretary, 346, High Road, Brondesbury, N.W.6.

Unemployment.—The total number of unemployed on November 29th was 1,496,100 (exclusive of persons who ceased work in the coal-mining industry on account of the dispute, and at that date remained disqualified for benefit). This was 18,653 less than on November 22nd, but 350,825 more than on November 30th, 1925.

New Italian Companies.—Among the companies recently formed in Italy are the Società Elettrificazione, Milan, capital one million lire; the Società Elettrochimica dell' Adda, Como, capital 50,000 lire; the Società Industriale Elettrica del Vitulanese, Benevento, capital 200,000 lire; the Società Italiana per l'Industria Elettrica, Milan, capital 500,000 lire; the Società Fabbrica Apparecchi Utilita Speciali Termoelettrici, Milan; and the Società Consorzio Consumatori Braidesi Energia Elettrica, Bra, capital, 115,000 lire.

The Engineering Industry During 1926.—In a retrospective article which appears in the December *Journal* of the Amalgamated Engineering Union, Mr. J. T. Brownlie, the president of the Union, says that at the beginning of the year they were hopeful that a general increase in wages would be conceded their members, but owing to circumstances beyond their control their anticipation was not realised; there were, however, advances in a number of districts. The Union's membership rose during the first part of the year, but after the general strike a decline set in; it is hoped now that the mining dispute is ended that membership will rise again. The average level of unemployment was 11.39 per cent. of the Union's membership, as compared with 9.66 per cent. in 1925. Reference is made to the bad state of the shipbuilding industry and to the growing use of internal-combustion engines in ships. Mr. Brownlie concludes his article upon an optimistic note and considers that the much-needed revival of trade in the engineering industry is likely to materialise in the near future.

New Municipal Showrooms and Offices.—The Blackburn Corporation has authorised the engineer to prepare plans and estimates for the erection of electricity showrooms and offices in St. Peter Street.

Registered Electrical Contractors.—At a meeting of the Executive Committee of the National Register of Installation Contractors on December 10th, applications for registration from the following were approved:—Kydd, R. H., South Shields; Condry & Harris, Edgbaston, Birmingham; Lockett, F., Rusholme, Manchester; Jefferson, T. W., Birkenhead; Palmer, R. F., Burnley; Hunt, R., & Co., Ltd., London, S.W.1; Kinsey, J. H., Cheetham, Manchester; Miller, H., Liverpool; Leppingwell, A. E., Alnwick; Stanton, W., Stockport; Greenwood, Thomson & Co., Glasgow; Wood, Ernest, Ltd., Altrincham; Thames Electric Co., Ltd., Kingston-on-Thames; Holdsworth & Co., Walsall. At the same meeting eight applications were declined.

British Columbia Telephones.—IMPORTANT PURCHASE.—According to an article appearing in the *Financial Times* for December 14th, the Associated Telephone and Telegraph Company has purchased a large interest in the British Columbia Telephone Co., which has headquarters at Vancouver and operates nearly 100,000 telephones in British Columbia. It it stated that the group of companies associated in the purchase also includes Theodore Gary & Co., London; the International Automatic Telephone Co.; British Insulated Cables, Ltd.; Cable Telephone and General Trust; and Siemens Bros. & Co., Ltd., London. Mr. J. G. Crane, of Kansas City, will be president of the holding company, which is handling the operation, and Sir Alexander Roger, chairman of the International Automatic Telephone Co., London, will be a vice-president. A statement attributed to Sir Alexander is to the effect that the purchase involves £3,000,000, and should be of great interest to manufacturers in this country.

The Timber Trade.—Our Timber Trade Correspondent reports that the stock position of building and general woods during the past month has been greatly relieved by large supplies from Northern Europe. These will keep the market fairly steady for buyers, although the stocks in the country are none too large should the great expansion of our Home industries, so generally anticipated, be realised. Large quantities of wood have been purchased on high freight rates, which are reflected on values of spot stocks. In hardwoods of all descriptions the market is firm, especially for mahogany and teak. Fancy woods, such as satinwood, rosewood, and ebony, are firm in value, but the demand for these is of much more limited character than the two previously-mentioned varieties.

New French Company.—A new company has lately been formed in Paris (9, Rue Sedaine), with a capital of 110,000 fr., and the title La Société Le Téléphone Automatique.

Our Foreign Trade.—The following were the values of imports and exports of electrical goods and machinery during November:—

	November, 1926. £	Inc. or dec. £	11 months, 1926. £
Imports—			
Electrical goods and apparatus	437,870	+ 12,222	− 471,026
Machinery	1,166,261	+274,351	+ 889,769
(Electrical machinery)	88,008	+ 9,408	+ 24,611
Exports—			
Electrical goods and apparatus	1,130,684	+261,819	+ 480,214
Machinery	3,990,438	+ 49,720	−2,976,567
(Electrical machinery)	594,537	+199,203	+ 87,870
Re-exports—			
Electrical goods and apparatus	13,416	− 152	− 49,301
Machinery	96,809	− 23,002	− 173,481
(Electrical machinery)	7,143	− 619	− 14,995

Birkenhead Town Council and Contractors.—Birkenhead electrical contractors have been in communication with the Electricity Department on the subject of discounts, and at the December meeting of the Town Council it was proposed to allow a discount equivalent to 10 per cent. of the cost of articles sold to contractors introducing purchasers to the Corporation's hire-purchase system. Dissenting councillors argued that contractors had no right to a discount if they did not bring the custom. The consumer who hired the stove should get the discount. As against this, it was pointed out that the object of the showroom was not trading, but increasing the demand for electricity and to encourage contractors and others to continue the supply of these particular goods. The showrooms were not opened to compete with private traders. Winding up the debate, Mr. Milne said that the Birkenhead contractors were far from satisfied, their contention being that as other towns granted a similar concession, Birkenhead should do likewise. The recommendation was referred back.

Installation Hire-Purchase at West Hartlepool.—In a recent report to his Committee, Mr. J. H. Parker, borough electrical engineer of West Hartlepool, says that originally the system of charging for energy on the Corporation housing estates was by prepayment meters, but about a year ago he suggested that a modified form of the domestic rate should be applied to those installations. The fixed charge required for those houses on the basis of the domestic rate averaged £2 5s. per annum, and, instead of collecting that sum in four quarterly instalments, he advised that 1s. per week should be collected with the rent, and that all energy used should be paid for monthly at the standard domestic rate of 1d. per kWh. As the 1s. per week brought in 7s. per annum more than was required for the fixed charge, a bowl fire and an iron were supplied to each consumer on the system, and the 7s. per annum was retained as the rental for the apparatus. That system of charge enabled an ordinary meter to be installed instead of a prepayment meter, and so saved 30s. on each house. Last November there were only 20 consumers on the housing estates whose total bill for electricity exceeded £2 12s. per annum, but to-day there are 292 consumers on the two estates who are paying a fixed charge of £2 12s. per annum, and are getting all their electricity at an additional charge of 1d. per kWh. The fact that these consumers pay for their electricity every month and therefore know what it is costing them and are using 650 electrical appliances, including cookers and water heaters, is striking evidence that electricity in the home is not a luxury to be enjoyed by the few.

As a further step, Mr. Parker recommends that other houses in the town should be treated in a similar manner, and estimates that a charge of 1s. 6d. per week would cover both the fixed charge and the cost of the installation (recovered in less than 10 years). He advocates the installation of three plugs, and a standard rate of 1d. per kWh. He recommends that from four to five hundred houses should be wired in this way at a cost of about £5,000.

New Indian Companies.—Among the new concerns recently organised in India in connection with electricity supply are the Gaya Electric Supply Co., 8a, Beadon Street, Calcutta, capital Rs.500,000; the Mozufferpur Electric Supply Co., of Mozufferpur, Bihar, capital Rs.600,000; and the Bhagalpur Electric Supply Co., of Bhagalpur, Bihar, capital Rs.1,200,000.

Calendars and Diaries.—A charmingly-illustrated wall calendar (about 16in. × 20 in.) for 1927 has reached us from CALLENDER'S CABLE & CONSTRUCTION CO., LTD., which always produces something of high standard. "The Taj Mahal," which has been wired with Callender cable, is depicted in beautiful colouring above a neatly-arranged calendar for the year.

From MESSRS. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, we have received a copy of their neat and usefully-spaced "Simplex Diary" for 1927. The 1926 Diary has been our constant and serviceable companion.

A pocket diary of convenient size has been sent us by MESSRS. E. BROOK, LTD., Huddersfield. Two days to a page gives ample space for memoranda, and the diary is prefaced by a good deal of postal and other useful information.

Unemployment in Germany.—The Berlin correspondent of *The Times* says that between November 15th and December 1st the number of unemployed persons in Germany in receipt of relief increased from 1,391,000 to 1,461,000. During the whole of November the number rose by 61,000, or 4.7 per cent. Up to the beginning of November it had been diminishing steadily since April.

Trade Announcements.—We are asked to state that the assets of MANDA MOTORS, LTD. (in voluntary liquidation), have been purchased by Electric Fans, Ltd., a company which is in course of registration, and, as the name indicates, will continue the manufacture of exhaust fans.

SUPERLAMP, LTD., has opened a new wholesale depôt at 5, Shrubbery Road, High Road, Streatham, S.W.16.

THE CHEAM MOTOR CO., LTD., of Ewell Road, Cheam, Surrey, has opened a separate radio department in connection with the business.

MR. SIDNEY PERRY, electrical contractor and radio engineer, of Canterbury, has opened branch premises at 139, High Street, Herne Bay.

THE NATIONAL UNION OF MANUFACTURERS has opened a branch at 78, King Street, Manchester, where the Union hopes to carry on and further its activities for the benefit of the manufacturing industry.

The address of MESSRS. A. C. SCOTT & CO., LTD., is now 99, St. James' Street, Manchester. Telephone: 9235 City; telegrams: "Cromaloy, Manchester."

An important amalgamation in the paint and varnish industry has recently taken place by the fusion of interests of the INDESTRUCTIBLE PAINT CO., LTD., and STANDARD VARNISH WORKS (OF GREAT BRITAIN), LTD. The latter company has for some years past marketed the products of Standard Varnish Works, New York. All these products, together with the specialities of the Indestructible Paint Co., will be manufactured in the factory recently erected at Park Royal, Willesden, N.W.10, the two companies operating under the title of Indestructible Paint and Standard Varnish, Ltd. The combine will be strengthened by the financial interest and close co-operation of the London Electric Wire Co. & Smiths, Ltd., who will continue to act as the selling agents for Great Britain of the "Standard" insulating specialities.

Catalogues and Lists.—MESSRS. PARMITER, HOPE & SUGDEN, LTD., Fauvent Electrical Works, Longsight, Manchester.—An illustrated and priced catalogue of Hope's patent "Aeroflex" light-duty fuses for pressures up to 460 V.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A pamphlet advertising the "Yale" flashlight, and List No. 466, containing suggestions for Christmas gifts. Both are illustrated and priced.

THE MITCHELL CONVEYOR & TRANSPORTER CO., LTD., Atlantic House, Holborn Viaduct, E.C.1.—A pamphlet containing pictures of installations of the company's wagon-unloading equipment.

THE HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—An illustrated booklet dealing with the correct use of accumulators in radio reception.

THE RUNBAKEN MAGNETO CO., Tipping Street, Ardwick, Manchester.—Two pamphlets (one illustrated and priced) advertising the "Runbaken" commutator for "Ford" cars.

MESSRS. ELLIOTT BROS. (LONDON), LTD., Century Works, Lewisham, S.E.13.—Section C of the company's general catalogue describing polyphase a.c. instruments.

MESSRS. L. MCMICHAEL, LTD., Wexham Road, Slough.—December blotter, advertising the "Dimic" four-valve receiving set.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—A well-produced catalogue (128 pp.) of electric wiring supplies and domestic appliances. The list illustrates all kinds of small switches, ironclad switch- and fuse-gear, conduit fittings, electric bells, radio accessories, battery chargers, fans, testing instruments, and heating and cooking apparatus.

HOPKINSON INDUCTION MOTORS, Willesden Lane, North Acton, W.3.—December stock list of single- and three-phase squirrel-cage and slip-ring motors (0.5 to 30 h.p.).

MESSRS. ARCHIBALD J. WRIGHT, LTD., 131, Bunhill Row, E.C.1.—An illustrated price list of torches, flashlamps, switches, toy dynamos and motors, domestic appliances, &c.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—December stock list of motors and dynamos.

MESSRS. CUTHILL, KING & CO., LTD., 32, St. Mary Axe, E.C.3.—An illustrated booklet describing the "Compulsoree" self-operating water circulator for land and marine boilers.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Book 6, dealing in detail with water-level indicators and alarms for reservoirs, &c. Illustrated and priced.

THE B.E.N. PATENTS, LTD., 100, Victoria Street, S.W.1.—An illustrated catalogue dealing with the Myers "Cyclone" automobile washer, for which the company is sole agent for the British Isles.

MESSRS. WM. GEIPEL & CO., Vulcan Works, St. Thomas Street, S.E.1.—A booklet dealing with "Okonite" insulating tapes for rubber-insulated cables and "Okonite" cement.

THE HART MANUFACTURING CO., 76 & 77, Rochester Row, S.W.1.—A showcard (16½ in. by 11 in.), advertising "Diamond-H" rotary switches for electric cookers.

MR. J. A. HIGGINS, 28, Park Street, Clayton, Manchester.—A priced and illustrated pamphlet advertising mining type electric lighting fittings, bells, &c.

MESSRS. LONG & CRAWFORD, LTD., 2, Gorton Road, West Gorton, Manchester, S.E.—Catalogue Section D, containing illustrated particulars of steel kiosk type outdoor sub-stations, and switch kiosks.

CARRON COMPANY, Carron, Falkirk.—A coloured showcard (16½ in. by 10½ in.), illustrating a "Carron" electric cooker in operation.

Bankruptcy Proceedings.—W. HEANEY, 12, Market Place, Henley-on-Thames, electrician.—The receiving order in this matter was made recently on a creditor's petition. The statement of affairs shows liabilities of £1,507, and there are no assets. Debtor attributes his failure to heavy loss by fire, loss by forced realisation of stock and trade effects, and bad debts. It appears that in July, 1922, he commenced business as an electrical engineer and contractor on his own account at Henley-on-Thames, with £300 capital, and purchased the freehold of the premises. In November, 1924, he was joined in partnership by another, who provided £1,500 for a one-fourth share in the business. The partnership was dissolved not long afterwards, the liabilities and assets of the business being taken over by the debtor, and the £1,500 provided by his partner being allowed to remain in the business secured by a second mortgage on the freehold premises. In 1925, the premises were seriously damaged by fire and the whole of his stock was destroyed. The premises were refitted at a cost of £1,500, of which £1,100 was recovered from insurance, a further sum of £1,300 recovered in respect of stock being used in payment of debts and the purchase of fresh stock. Debtor stated also that in April, 1926, the whole of his stock and trade effects were sold under an execution, and realised about £100. He had since undertaken jobbing work, and with a view to raising further capital, arranged, in association with another, to form a limited company with a nominal capital of £1,000 to take over the business, but two judgment creditors having instituted the present proceedings, the registration of the company was not proceeded with.

The following are creditors:—

	£		£
Cooper, Son & Caldecott ...	235	House, Sonning & Co., Ltd. ...	25
Caldecott, A.	35	Lewtas (J. & F. A.) & Co., Ltd.	20
Cordery, Mrs. L. C	55	Marconiphone Co., Ltd.	25
Falk, Stadelmann & Co., Ltd. ...	23	South-Midland Towing & Transport Co., Ltd.	30
General Electric Co., Ltd. ...	65	Spencer, Ell & Co.	60
Heaney, Mrs. A. B.	250	Wiesner, G. A.	30
Houghton-Butcher & Co., Ltd.	65		
Harris & Co.	105		

R. L. BROCK, trading as R. L. Brock & Co., 5, Bedford Row, Tavistock Road, Plymouth, electrical engineer and radio dealer.—The receiving order in this matter was made recently on a creditor's petition. The statement of affairs shows liabilities of £1,723 and net assets of £355, leaving a deficiency of £1,368. The debtor attributes his failure to bad trade, heavy expenses, and losses in partnership. The deficiency account shows a net trading loss since December 31st, 1923, of £263, bad debts £102, household and personal expenses £895, and amount paid out to late partner £316. Debtor states that he commenced trading at Christmas, 1919, as an electrical engineer with £120. In March, 1924, he entered into partnership with another person engaged in the wireless trade, the agreement providing that debtor's contribution to the capital should be £434, of which £155 was paid as a premium by the partner, and £434 was also contributed by the partner. The firm dissolved partnership in September, 1925, but accounts were not settled between them until March 22nd, 1926, on which date an agreement was entered into by which debtor's partner acquired the assets of the wireless department and agreed to meet the liabilities incurred in that department. Debtor received the remaining assets and undertook the remaining liabilities. Debtor states that he endeavoured to establish a country electrical round, but found the expenses too heavy. He further alleges that work had been under-estimated for or defectively executed by his employés, with consequent loss. On September 1st last he executed a deed of assignment, and a statement was issued to the creditors showing his estimated unsecured liabilities to be £2,018, and assets £847. He has been aware of his financial position during the past year, but considered that by curtailing expenses he could set matters right. At the first meeting of the creditors held recently it was resolved to appoint Mr. J. S. B. Hole, of Monument House, Monument Street, London, E.C.3, to act as trustee, while a committee of inspection was also nominated. The following are creditors:—

	£		£
Brock, Mrs. R. L.	56	Bankers	63
Clark, Mrs.	159	Siemens Bros. & Co., Ltd. ...	20
Falk, Stadelmann & Co., Ltd.	20	Siemens & English Electric Lamp Co., Ltd.	111
Watkinson, Frederick	190	Warwick, W.	112
Hammond, C. W.	72		
Lithanode Co., Ltd.	102		

R. V. G. SELLERS, Town Hall Buildings, Banbury, Oxfordshire, wireless engineer, trading as the Wireless Supplies and Installations.—The receiving order in this matter was made recently, on debtor's own petition. The first meeting of creditors was held on November 11th, at Oxford, when the case, being a summary one, was left with the Official Receiver as trustee. The following are creditors:—

	£		£
Wrench's Garage	42	Humphris, H. O.	23
Flinders (Wholesale), Ltd. ...	43		

F. A. HARTLEY and R. HARTLEY, trading as F. A. Hartley and Son, 98 Katherine Street, Ashton-under-Lyne, electrical engineers.—The public examination of these debtors was held

recently at the Town Hall, Ashton-under-Lyne. The joint statement of affairs disclosed gross liabilities of £696, against assets of £237. Debtors attributed their failure to lack of capital, bad trade, keen competition, and illness of R. Hartley. It appeared that in November, 1919, they purchased the business for £100. The vendor was the widow of another son of F. A. Hartley, and they also arranged to pay her £1 a week until June, 1927. They borrowed £500, but repaid it. According to figures prepared by accountants, the business had a deficiency of £775 on September 1st, 1925, and since then, after charging partners' salaries of £416, a loss was incurred to September 24th of £204. The examination was closed.

E. G. BATT, electrical engineer, 20, Iverna Gardens, Kensington, and Magnet House, Kingsway, W.C.—At the adjourned first meeting of creditors, held on December 7th, at the London Bankruptcy Court, a resolution was passed for Mr. H. E. Cooper, 1-2, Bucklersbury, E.C., to wind up the estate as trustee, with a committee of inspection to be thereafter appointed. The debtor has lodged accounts showing liabilities of £1,239 (unsecured £1,199), and assets nil.

L. L. JAMES (W. G. James & Son), electrical engineer, 62, Canterbury Street, Gillingham, and 137, High Street, Rochester.—Discharge suspended for two years until November 10th, 1928.

A. A. WATMOUGH (separate estate), 41, Town Street, Horsforth, near Leeds (carrying on business with another as Hurworth, Watmough & Co.), electrical engineer.—Last day for receipt of proofs for dividend, December 28th. Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds.

N. H. PAYNE, 4, The Triangle, Teignmouth (late of Dawlish), electrical and wireless engineer.—Receiving order made December 7th on debtor's own petition.

J. H. DOLLITTLE, Portsmouth Road and 17, Park Street, Guildford, wireless engineer (trading as the Zenith Radio Manufacturing Co.).—Last day for receipt of proofs for dividend, December 28th. Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C.1.

W. H. DICKSON and A. J. SOLOMAN (trading as "Dickson and Soloman"), 13 and 14, Tavistock Street, Devonport, electrical and wireless engineers.—Receiving order made December 8th on debtors' own petition.

H. ROGERS, Friars Gate and Barbauld Street, Warrington, electrical engineer and contractor.—Trustee, Mr. B. Silcock, 31, Bold Street, Warrington, released July 27th. (Gazetted December 10th.)

Private Arrangements.—F. GILL, electrician, Skipton Road, Ilkley.—A meeting of creditors was held recently, when the representative of Metro-Vick Supplies, Ltd., the principal creditors, was elected to the chair. The statement of affairs showed liabilities of £659, of which £503 was due to the trade. The net assets were £189, leaving a deficiency of £470. It was reported that the debtor commenced trading in May, 1924, at his home address, with little or no capital, and in January last he took his present shop. A resolution was passed in favour of the matter being dealt with under a deed of assignment, with Mr. Rayner, accountant, as trustee, together with a committee of the principal creditors. The following are creditors:—

	£		£
Ingham Bros.	60	Metro-Vick Supplies, Ltd. ...	180
Douthwaite, W. L., Ltd. ...	121	Creenwood, Rayner & Co. ...	20
Tunnicliffe & Glover	32		

Company Liquidations.—MANDA MOTORS, LTD., 53-54, Royal Mint Street, E.1, electrical engineers.—A meeting of creditors was held on December 7th, at the offices of Messrs. Fincham, Partridge & Co., C.A., 3, Warwick Court, W.C.1. The chair was occupied by Mr. A. H. Partridge, the liquidator of the company. The statement of affairs showed liabilities of £8,966, and the assets were estimated to realise £846, from which had to be deducted £186 for preferential claims, leaving net assets of £660, or a deficiency so far as the creditors were concerned of £8,306. The issued capital of the company was £2,000, and as regarded the shareholders there was a deficiency of £10,306. Mr. Partridge stated that a private meeting of creditors was held on November 9th last, when an offer was made of payment in full by two bills at six and 12 months. The directors also offered to stand aside in respect of their claims, and to provide the necessary finance for the business to be continued until trade became normal. The creditors accepted the offer, subject to the first 5s., which was one-half of the first bill, being guaranteed. Most of the creditors assented to the proposal, but they were warned that if proceedings were taken against the company the offer could not go through. One creditor refused to assent to the arrangement, and obtained judgment against the company. This creditor intimated that unless his claim was settled he would enforce his judgment, and in the circumstances the company went into voluntary liquidation. Shortly after the liquidation an execution was levied by the creditor, and the sheriff was in possession. The chairman added that as the liquidator he claimed the assets of the company, but his title to them was being disputed, and the matter would have to be settled by the Court. If the original offer had been universally accepted the creditors would have received payment in full, but the position was now entirely altered. An offer of £1,000 had been received for the assets, and if it could not be increased he would accept it. A creditor inquired how the company had traded at such a substantial loss in less than two years, and Mr. Partridge replied that it was a new business, and money had to be spent in order to build up a connection. Just as the company was getting to the profitable stage the coal dispute occurred, and that altered everything. The directors had found thousands of pounds to keep the company going, and had never drawn a penny from the concern. A resolution was unanimously passed confirming the voluntary liquidation of the company, with Mr. Partridge as liquidator, and it was also decided that, failing any increase, the offer of £1,000 for the assets should be accepted. The following are creditors.

	£		£
Veno Co.	127	*British Trade Journal*	27
Sellars (Richmond), Ltd.	43	*Cold Storage*	32
Bolton, Thomas, & Sons	50	Engineering Publications, Ltd. ...	27
London Electric Wire Co. and Smiths, Ltd.	64	*Ironmonger*	38
Ransome & Marles Bearing Co.	46	Wilson, F.	25
Wholesale Fittings Co.	28	Stepney Borough Council ...	36
L.P.S. Electrical Co.	32	Hampshire & Co.	21
Sankey & Sons	30	Fincham, Partridge & Co. ...	36
British Home & Office Telephone Co., Ltd.	96	Newstead & Co.	146
		Holdershaw, —	109
		Globe Pneumatic Co.	27

ALPHA ELECTRIC & OXY-ACETYLENE WELDING CO., LTD.—A meeting of creditors is to be held on December 22nd at the offices of the liquidator, Mr. F. Reed, Westgate Chambers, Newport, Mon.

LLANDRINDOD WELLS ELECTRIC LIGHT AND POWER CO., LTD.—Particulars of claims to be sent to the liquidator, Mr. G. Edwards, The Offices, Llandinam, Montgomery, by December 22nd.

NATIONAL WIRELESS CORPORATION, LTD.—A petition for the winding up of this company has been presented to the High Court by Mr. P. H. Camp, Luton, a creditor, and will be heard in London on December 21st. Persons desiring to appear must communicate with Messrs. Jordan & Lavingdon, 78, Queen Victoria Street, E.C.4, by December 20th.

Dissolution of Partnership.—BERNARD HOLLAND & Co., engineers and merchants, 17, Victoria Street, S.W.1.—Messrs. B. A. Holland and A. M. Warlow have dissolved partnership. Debts will be attended to by Mr. Holland.

New "Frigidaire" Showrooms at Birmingham.—The Delco-Light Company (General Motors Corporation), of Imperial House, Kingsway, W.C.2, has taken premises as showrooms and offices at 242-244, Corporation Street, Birmingham, and there on December 7th it launched a "Frigidaire" campaign. At the informal opening of the showrooms there were present, among others, Professor Wm. Cramp (head of the Electrical Engineering Department of the University of Birmingham); Mr. R. A. Chattock (city electrical engineer, Birmingham), Mr. F. Forrest (Electricity Department); Mr. W. Y. Anderson (commercial manager of Birmingham Corporation Electricity Department); Dr. W. H. Davison (Public Health Department), Mr. F. Baker (President, Birmingham Butchers' Association); and Mr. Roy (Bakers' Association). Representing "Frigidaire" were Mr. H. L. McGurk (managing director), Mr. Cyril W. Daborn (assistant manager), Mr. H. C. Tofield, A.M.I.E.E. (newly-appointed manager of the Birmingham Branch), and Mr. J. B. Daniels, one of the company's foremost distributors. Mr. McGurk gave a demonstration of the manner in which refrigeration was accomplished, and provided details of the low cost of running. In the case of the household cabinets, sufficient for an ordinary family, the total amount of electricity consumed, he said, averaged not more than 2 to 3 kWh per day. The various models for household and commercial use were displayed, and were inspected with much interest.

A luncheon followed at the Queen's Hotel, and Mr. MCGURK, who presided, outlined the policy of the company in relation to the manufacture and distribution of the company's products. He said that at present it was not economically possible to construct in this country the metal household products, but the whole of the commercial cabinets were made in London; and he entertained the hope that the amount of business received from Birmingham would justify the company's opening a factory there for the manufacture of commercial cabinets. Messrs. J. Lyons & Co., Ltd., had already taken nearly 3,000 units, and were adding more week by week, and Messrs. Woolworth's were installing equipments in every branch. Equipments had been installed by Slater's, Jarley's, the Express Dairy Co., A.B.C., and Hill & Son, and other large corporations were considering the matter.

In replying to the toast of "The Guests," Professor CRAMP said that he looked forward to the day when the company would be in a position to construct the whole of its products in this country.

Recent Contracts.—MESSRS. JOHNSON & PHILLIPS, LTD., have received a repeat order for a large quantity of "J. & P." wiring system cable and fittings from the Farnworth Urban District Council in connection with municipal housing extensions.

The HARLAND ENGINEERING CO., LTD., has recently secured two orders for Harland sectionalised electric drives for paper mills. One is for the Westfield Paper Co,, Bathgate, and includes eight 35-h.p. and four 24-h.p. motors with switchgear and special speed controlling equipment for giving a range of from 35 to 350 ft. per minute. The other equipment, for Messrs. Caldwell's Paper Mills, Ltd., Inverkeithing, is similar. These bring the total number of Harland drives installed or on order to 58.

Social Events.—At the annual dinner of the Preston Corporation electricity staff on December 7th (Mr. J. F. Simpson, electrical engineer, presiding), Mr. J. A. Robertson, proposing the toast of "The Department," dealt with the progress of electricity in Preston. Coun. Heaney, in reply, said when the Corporation took over Crown Street works the plant capacity was 2,500 kW, as against 11,700 kW to-day. The number of consumers had increased from 3,000 to 7,000.

The Bow generating station staff of the Charing Cross Electricity Supply Co., Ltd., held their annual dinner at the Adelaide Galleries, Strand, on December 3rd. Mr. J. M. Gatti, managing director, presided, and the company included Mr. S. L. Pearce, the recently-appointed engineer-in-chief to the London Power Co., and Mr. W. B. Thorpe, engineer-in-chief to the Charing Cross company.

Irish Free State Electrical Imports.—The imports of electrical goods, excluding machinery, into the Irish Free State during October last amounted to £45,967, as compared with £58,983 in October, 1925. The official returns for the first 10 months of the year show a total of £373,645, as compared with £308,015 in the corresponding period of 1925.

Book Notices.—"The Practical Engineer Electrical Pocket Book and Diary, 1927." Edited by Conrad Arnold, A.M.I.E.E. Pp. cxxii+662; illustrated. London: Messrs. Humphrey Milford. Price 2s. 6d. net cloth and 3s. net pluviusine.—The 28th edition of this yearly publication has been subjected to careful revision and condensation, and the section on mining has been rewritten by Mr. R. M. Chalmers, of the Wigan Mining College.

"The Marketing Problem, How it is Being Tackled in U.S.A.," by E. T. Elbourne. Pp. xi+216. London: Longmans, Green & Co., Ltd. Price 10s.

"The Radio Year Book, 1927." Illustrated; pp. xx+176. London: Sir Isaac Pitman & Sons, Ltd. Price 1s. 6d. net.—This useful book of reference is now in its fifth year. In addition to the usual information, the contributions by well-known radio engineers and scientists include an article by Mr. J. H. Baird on his method of "Television."

Indian Electrical Imports.—Our Indian correspondent informs us that the trade figures for the first half (April-September) of the current fiscal year show that the improvement in the electrical trade recorded in the year 1925-26 has continued. The total imports of electrical machinery during the period amounted in value to Rs.111 lakhs, as against Rs.96 lakhs in the corresponding period of the previous year. The principal increases were in generators, from Rs.16 lakhs to Rs.24 lakhs, in transformers, from Rs.7 lakhs to Rs.11 lakhs, and in turbo-generator sets, from 3¾ lakhs to 5¼ lakhs. The United Kingdom's share of the total imports increased from 76 lakhs to 91 lakhs. The United States also increased its share from 7 lakhs to 9 lakhs. Germany's share slightly declined, though in the previous year she showed noteworthy development. As regards the trade in electrical instruments and apparatus, the total imports during the half-year amounted to Rs.120 lakhs, as against Rs.113 lakhs. The United Kingdom's share increased slightly, from 73 lakhs to 76 lakhs, but the United States was able to increase its share from Rs.12 lakhs to Rs.20 lakhs. The progress made by the United States in the Indian market in recent years is noteworthy.

Lighting and Power Notes.

Accrington.—TERMINATION OF AGREEMENT.—The borough electrical engineer has received a communication from the Lancashire Electric Power Co., giving notice of its intention to terminate its contract with the Corporation from the end of the year, and stating that although it would commence operating Padiham station regularly from June 1st, it might be found advantageous for a short period to take night and weekday supplies from this system.

LOAN SANCTIONED.—Sanction has been received to a loan of £50,000 for electricity purposes.

Australia.—MELBOURNE.—Extensions to the city electricity undertaking involving an expenditure of £127 000 for the financial year 1927-28 have been approved by the City Council. For the power house it is proposed to install additional a.c. switchgear to cost £2,300. The construction and equipment of new rotary convertor sub-stations, including two 2,500-kW rotary convertors, switchgear and crane, is estimated to cost £55,310, while a sum of £1,850 is set down for the construction of two static sub-stations, transformers and switchgear. The extension of mains and feeders is estimated to cost £56,430, including £17,870 for fibre conduit, while the remainder of the amount will be required for providing meters and indicators, instruments, tools, and other equipment.

KALGOORLIE (W.A.).—The special Committee appointed by the Western Australian Government to investigate the proposal to assist the Kalgoorlie mines by the establishment of a Government-controlled central power station, has reported favourably. The Government station should be designed for the use of pulverised fuel and the installation of steam-driven turbo-generators with an initial load of 4,000 kW. The cost is estimated at £227,000.—*Tenders.*

Bristol.—LOAN.—The Electricity Committee is applying for sanction to a loan of £85,000 for services.

NEW POWER STATION.—The Electricity Commissioners have now consented to the scheme for the erection of a generating station at Portishead, and the Committee proposes to proceed with the work forthwith.

CHANGE-OVER.—The fourth section of the change-over scheme is to be commenced, the estimated cost being £200,000.

Cambridge.—ELECTRICITY SUPPLY.—The Electricity Supply Committee has submitted a report to the Town Council upon the subject of negotiations with the Cambridge Electricity Supply Co., relative to its application for an extension of tenure. According to the *Cambridge Daily News*, the Committee intimated to the company that its proposals for dealing with this application would be upon the understanding that the company should not erect a new generating station, but should take a supply in bulk and carry on the business of distributors only of energy, so that, in the event of any option to purchase which might be exercised, the Corporation should not be obliged to buy a larger station than was necessary for the needs of Cambridge. The company asked that the question of a new station or the taking of a bulk supply might be left open, as the erection of a new station might result in the giving of a cheaper supply rather than by taking a bulk supply, but that this could not be definitely ascertained until estimated figures had been obtained. The Committee is prepared to resume negotiations as soon as the question has been settled.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Toronto correspondent of *The Times* reports that the lease of the National Hydro Company for the development of power at Carillon Falls, on the Ottawa River, which was granted in 1921, has been renewed by the Federal Government until May 1st next. On that date the charter of the Georgian Bay Canal Company must be renewed. This places the National Hydro Company and the Georgian Bay Canal Company in an equal position relative to power development on the Ottawa river.

ST. LAWRENCE DEVELOPMENT.—The International Joint Engineering Board, which for the last two years has been considering the question of the proposed improvement of the St. Lawrence river from Montreal to Lake Ontario, for both navigation and power, has completed its report. According to the *Electrical World*, the report indicates that the American and Canadian engineers have failed to agree on a plan for the development of the Great Lakes-St. Lawrence waterways. The American engineers propose a full single-stage development in which all the practical head available in that section of the river would be concentrated in one dam below Long Sault Rapids at the foot of Barnhart Island. The Canadian engineers favour the development of power at Ogden Island, near Morrisburg, and at the Long Sault in a double-stage scheme. The total installed capacity of the two plans would be: Single-stage (American scheme), 2,730,000 h.p.; double-stage (Canadian scheme), 2,619,000 h.p. The cost of the schemes would be $290,172,000 and $308,792,000, respectively. The time to complete all works is estimated at eight years.

Cardiff.—EFFECT OF COAL STOPPAGE.—According to the *South Wales News*, a report recently submitted to the Electricity Committee on the effect of the coal stoppage on the electricity undertaking, stated that after including commitments when collieries resumed working, the increased cost of coal amounted to £35,000 over last year. It was estimated that consumers with agreements having a coal clause would meet this additional cost to the extent of £7,500, leaving £27,500 net increase. Increased loan charges of £8,000 would, it was expected, be met by reduced revenue expenditure on other items. Whilst April showed an increased output of 14.5 per cent., subsequent months up to November showed a decrease, resulting in a reduction of nearly 500,000 kWh. This reduction and that due to lower tariffs, which did not come into force until December last year, affects the revenue to an estimated amount of £5,250, which, added to increased expenditure of £27,500, gave £32,750 as the estimated net reduction in the trading results for the year. The surplus last year was £50,175. Increased revenue might reasonably be expected for March quarter, as output already showed a small increase, but no allowance had been made for this in the figures given. The Committee decided to make no increase in the electricity charges.

Colchester.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £10,000 for feeders and distributing mains.

Cornwall.—ELECTRICITY SUPPLY.—Work has been commenced on extensions at the Hayle power station of the Cornwall Power Co., Ltd. A new engine and boiler house is being erected at the works in order to accommodate a 7,500-kW turbo-alternator and three boilers which are on order. This plant will form a complete equipment, with its own condensing plant and 10,000-V switchgear. With the new installation the capacity of the Hayle power station will be increased to 17,200 kW. The new plant will allow of an additional main being carried from Hayle to the tin-mining area, with a connecting main at another point, the proposal being to serve power to mining districts which are at present untouched. In the coming spring it is intended to carry the mains to Truro to supply electricity in that area.

Clacton-on-Sea.—ELECTRICITY EXTENSIONS.—At a recent meeting of the Urban District Council the Electricity Committee submitted a report prepared by the electrical engineer for additional plant at the electricity works, in order to cope with the load anticipated next year. The estimated cost of the proposed extension is £15,900, made up as follows:—

Extension of engine room, £1,200; one 1,125-b.h.p. Diesel engine, £11,500; one 750-kW generator, £1 800; foundation, £800; extension to switchboard platform, £100; cable, instruments, switches, &c., £300; loan charges and contingencies, £200. The Committee recommended that the proposals be adopted and application made for sanction to a loan to carry out the work. It was also recommended that a h.p. feeder cable be laid from the works to Little Holland, and that a sub-station be erected there, the estimated cost of the necessary plant being £8,500. Both reports were adopted.

Continental.—GERMANY.—The Rhenish-Westphalian electricity works have now been coupled up with the big power station at Mannheim. The former power station transmits electricity at 220,000 V, and as the Bavarian station on the Walchensee is also connected through the Mannheim station with the Ruhr, and through the Ruhr with the Moddergrube, the network is complete and electricity is available throughout Western and Southern Germany.—*Reuter* (Cologne).

FRANCE.—The Council of the Nord Department has voted a sum of 15 million fr. towards the cost of extending electricity supply facilities in the rural parts of the Department.

A breakdown at St. Denis electricity works, Paris, on December 10th resulted in the failure of the electricity supply on practically the whole of the right bank of the Seine. A thick fog hung over the city at the time, and the unexpected demand for lighting put a strain on the machines and caused the breakdown.

SWITZERLAND.—The municipal authorities of Zurich are at present considering a scheme for the establishment of a new hydro-electric power station with a capacity of 22,000 h.p. on the Limmat, near Wettingen.

ITALY.—Work has begun on a large hydro-electric power station at Cardona. The annual output is placed at 500,000,000 kWh, the greater part of the electricity being supplied to the provinces of Lombardy and Piedmont. Hydraulic power will be obtained by the diversion of the River Isarco through a tunnel 16 km. long, providing a fall of 75 metres. It is planned to complete the work within two years.—*Reuter's Trade Service* (Milan).

Hastings.—ELECTRICITY SUPPLY.—The Electricity Committee is applying for sanction to supply electricity at Sedlescombe and Kent Street. The estimated cost of the scheme is £15,000.

London.—BREAKDOWN.—An employé of the City of London Electric Lighting Co., whilst working at the power station, drove a spike through a cable, causing a failure in the electricity supply which lasted about 15 minutes. The workman received a severe shock and was taken to Guy's Hospital.

Northern Ireland.—PORTSTEWART (CO. LONDONDERRY).—At the meeting of the Urban District Council on December 8th, it was decided that the construction of the new electric generating station be deferred for one year in view of the proposed Bann power scheme.

Padiham.—INAUGURATION OF SUB-STATION.—The new transformer station of the Lancashire Electric Power Co. was recently formally inaugurated by the chairman of the Urban District Council. Electricity is received at a pressure of 11,000 V, and reduced to 230 and 400 V for distribution. The cost of the scheme was £84,000.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

SPENBOROUGH.—An increase of 10 per cent.

LEEK.—An increase of 25 per cent.

BARNSTAPLE.—A further increase of 10 per cent., making a total advance of 20 per cent.

Seaton (Cumberland).—ELECTRICITY SCHEME.—The Parish Council has recommended to the Rural Council the adoption of overhead lines for the supply of electricity to the parish. The cost is estimated at £3,992, as against £5,644, by using underground mains.

Southport.—PROPOSED NEW PLANT.—The borough electrical engineer is to interview the Electricity Commissioners with a view to securing their sanction to the installation of a new 6,000-kW turbo-generator and further water-cooling equipment, the total cost being estimated at £35,000.

Spalding.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £26,955 in connection with the electricity scheme for the district.

Spenborough.—LOANS SANCTIONED.—The Urban District Council has received sanction to the following loans:—Mains, £12,500; sub-station equipment, £2,200; sub-station, £300

Swansea.—ELECTRICITY SCHEME.—The *Western Mail* reports that the Corporation electrical engineer (Mr. J. W. Burr) has reported to the Corporation that a comprehensive scheme to provide electricity for all should be instituted for the borough, and he has asked for authority to prepare such a scheme. He states that he has been searching for a site for a new station, but at present has not found one available.

MAINS EXTENSIONS.—The Corporation Electricity Committee has agreed to the following extensions of mains:—Lime Works, Norton, £900; Gelli Grafog estate, £5,115; Delabeche Street, £1,485; and small extensions to other streets.

Torquay.—NEW RING MAIN.—At a meeting of the Town Council, on December 7th, the town clerk reported that the Electricity Commissioners had not yet issued an Order authorising the Council to lay a ring main from Newton Abbot power station through Ipplepen and Marldon to Paignton, and that owing to the increase in the load it was necessary for the new ring main to be in commission by next winter, and the laying of the cable to be commenced early in the New Year. He had therefore applied to the various highway authorities for their consent to the laying of the cable, pending the issue of the Order, and certain of them had already given permission. The engineer advised that the conducting section of the cable should be increased from .15 sq. in. to .20 sq. in., which would deliver 5,000 kVA into Paignton and Torquay, as against 4,000 kVA, making the cost of the cable £22,265, plus £3,150 for erecting the necessary stations and providing switchgear. The action of the town clerk and engineer was confirmed, and they were instructed to carry out the scheme as recommended. Application is to be made for sanction to the necessary loan.

SCHEMES SANCTIONED.—Sanction has been received to the following schemes:—(1) The change of system of supply in a portion of the urban district of Newton Abbot; (2) and the establishment of a main transmission line in connection with the Teignmouth bulk supply.

LOAN.—Application is being made for sanction to a loan of £7,000 for mains.

Whitehaven.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £1,290 for mains.

Workington.—PRICE REDUCTION.—The Corporation has reduced the charge for electricity for heating purposes from 3d. to 2d. per kWh.

York.—LOAN.—The Electricity Committee is applying for sanction to a loan of £3,000 for transformers.

Tramway and Railway Notes.

Australia.—MELBOURNE.—According to the *Industrial Australian and Mining Standard*, estimates for tramways in the suburban municipalities of Northcote, Preston, and Heidelberg, prepared by the Melbourne Tramways Board, are being considered by a joint conference. The route is from Northcote to Ivanhoe railway station. The cost of a single track, with rolling stock, depôts, buildings, &c., is £95,250. The total expenditure by the board during the first year of operation would be £25,297, and the revenue from the first year of operation is estimated at £5,250. The proportion of the loss chargeable to the municipalities concerned is:—Northcote, £9,447; Preston, £3,900; Heidelberg, £6,700. These sums would be reduced to £7,587, £3,130, and £5,380 respectively at the fifth year.

Birmingham.—PROVISIONAL ORDER.—The Minister of Transport has made a Provisional Order authorising the construction of light railways in the city in connection with the existing tramway undertaking. The works to be carried out by the City Council include the extension of the Hall Green route to the city boundary extension of the Tyburn Road route to Chester Road, and an extension of the Bordesley Green route along a road to be constructed. Other smaller extensions are contemplated.

Chile.—RAILWAY ELECTRIFICATION.—Plans have been submitted to the Minister of Public Works for the electrification of a number of railways in Chile. The first enterprise will be the main line between San Antonio and Talca. Large hydro-electric works will be necessary, the waters from the Maipo, Aconcagua, and other rivers being utilised for the provision of electrical energy.—*Reuter's Trade Service* (Santiago).

Continental.—HOLLAND.—Considerable progress has been made with the electrification of the railway service between Amsterdam and Rotterdam. The section between Haarlem and Rotterdam will be opened for traffic on March 15th and that between Haarlem and the North Sea port of Ymuiden on May 1st, whilst the entire section between Amsterdam and Rotterdam is to be opened for express electric traffic on October 1st, 1927.—*Reuter* (Amsterdam).

Edinburgh.—NEW CARS.—At a meeting of the Tramways Committee on December 9th, the manager submitted a report in which he recommended that 24 new car bodies be constructed at Shrubhill workshops at an estimated cost of £750 each, making a total of £18,000.

United States.—NEW ELECTRIC RAILWAY.—According to the *Electric Railway Journal*, preliminary plans have been completed for the extension of the Piedmont and Northern Railway from Charlotte to Durham, a distance of 150 miles, and from Gastonia to Spartanburg, S.C., a distance of 50 miles. The construction of the proposed new lines will involve an expenditure of about $15,000,000. Like the portions of the Piedmont and Northern already constructed, the new lines will be electrically operated, the energy being supplied by the Southern Power Company.

Telegraph and Telephone Notes.

Brazil.—WIRELESS TELEGRAPHY.—A new direct means of wireless communication has been established between Brazil and Germany. The German sending station is at Nauen, near Berlin, and the Brazilian receiving station at Rio de Janeiro.—*Reuter's Trade Service* (Rio de Janeiro).

France.—LONG-DISTANCE TELEPHONY.—At the recent annual meeting of the Société des Etablissements Industriels de E. C. Grammont et de A. Grammont, it was stated that during the year its works had completed a new long-distance telephone cable between Paris and Havre. The amplifying apparatus and relays had been manufactured in the works of its Lyons-Dauphine associated concern, and tests had shown them to be equal to those of American manufacture.

Irish Free State.—TELEPHONE SERVICE.—In 1922 the number of telephones connected with the public service in use in the Free State was 19 076. In four years that number has increased by nearly 27 per cent., reaching the total of 24,239, a very gratifying measure of progress; but even more satisfactory is the fact that the increase has not been concentrated in provincial town areas. During the last four years the number of miles of single wire in use for subscribers rose from 41,880 to 70,450, which shows an increase of nearly 68 per cent., and also indicates that a rural system has begun to come into being all over the Free State counties.

Italy.—TELEPHONES ON TRAINS.—The Italian Ministry of Communications announces that wireless telephones are to be installed on express trains in Italy. The system will be based on the principle now adopted in Germany. A start will be made on the Milan-Bologna and the Milan-Turin expresses.

Rumania.—STORM DAMAGE.—There has been considerable interruption of telegraph and telephone communication in Rumania as a result of a three days' gale. On December 8th practically all communication had been restored.—*Reuter* (Bucharest).

The Telephone Service.—MANCHESTER DEVELOPMENT.—The annual report of the Telegraph and Telephone Advisory Committee for the above area records satisfactory progress in nearly every direction. The construction of automatic exchange buildings has been retarded owing to materials having been delayed by the coal dispute. Complete new exchange equipments have been brought into use at Knutsford, Openshaw, and Whaley Bridge, and substantial additions have been made to the equipment at 16 other exchanges, and arrangements are in hand for providing new equipment or new exchanges at other places. During the year ended September 30th, 1926, some 10,679 new telephones were fitted; after allowing for cessations this shows a net increase of 5,475, or 7½ per cent., and, in general, new services can now be given in the majority of cases within one or two weeks from the date of the order. During the past year the underground wire mileage has increased by 53,412 miles. Several additional long-distance circuits from Manchester and the surrounding industrial areas to London, and other important centres, have been brought into use by means of the various repeater stations associated with the main underground cable routes; in the Head Post Office are 90 repeaters, and accommodation has been arranged for an ultimate provision of 300 repeaters. The number of effective trunk calls and telegrams was 5,794,238, an increase of nearly half-a-million. Local effective calls numbered 56,946,645, an increase of over 10½ millions on the previous year's figure. Complaints relative to service and plant defects continue to decrease. The average number of written complaints received monthly during 1926 was 197, as against 288 during the previous year. The average time taken by a telephonist to answer subscribers' calling signals during 1926 was 5.7 seconds, as against 6.0 seconds during the previous year. Street kiosks have increased from 119 to 193. A new "Phonogram" room has been opened at the Manchester office, and the latest type ancillary panel board has been introduced. Considerable progress has been made throughout the district in the transfer from manual to automatic working of internal private branch exchanges.

TELEGRAPHS.—The possibilities of voice-frequency telegraph circuits between Manchester and London are being investigated by the Post Office Research Department, and it is expected that an experimental circuit will be installed shortly to try out the system.

"MISSED CALLS."—It is reported that steps are being taken by the London Telephone Service to provide a "Missed Call Department," so that telephone subscribers will be able to ascertain the telephone numbers of callers who have rung them up in their absence.

NEW AUTOMATIC EXCHANGE.—At midnight on December 12th Oxford subscribers were transferred from the manual to the automatic system. Some confusion apparently resulted owing to a large number of subscribers failing to follow instructions.

Venezuela.—NEW WIRELESS STATION.—The Government has concluded a contract with Marconi's Wireless Telegraph Company for the erection of a high-power station at Maracay. It was originally proposed to erect the station at Caracas, but it has been found inadvisable to do so.—*Reuter's Trade Service* (Caracas).

Radio Notes.

Belgium.—NEW WAVE-LENGTHS.—It is understood that the redistribution of European wave-lengths introduced by the Union International de Radiophonie, of Geneva, some weeks ago has been approved by 95 per cent. of listeners in Belgium.

France.—NEW STATION.—Strasburg is to have a powerful broadcasting station as the result, says the *Daily Mail*, of the action of a group of Alsatian patriots interested in replying to the Germans who recently strengthened their propaganda station at Freiburg-im-Breisgau.

Holland.—NATIONAL COMMISSION.—The Commission appointed by the Algemeen Nederlandsch Verbond to find a solution of the state of affairs arising out of the report of the Royal Commission on National Broadcasting started its work on December 10th, says *World Radio*. Besides the chairman and vice-chairman of the Verbond, the Commission consists of six members from Amsterdam, The Hague, and other parts of Holland.

Irish Free State.—LICENCE LEGISLATION.—Mr. J. J. Walsh, Irish Free State Minister of Posts and Telegraphs, announces that the new broadcasting station at Cork will be completed by about March, and that it is intended to erect a station at Athlone, with a radius of 80 to 100 miles for crystal reception, and that it is also proposed to erect stations for the Irish-speaking districts. The Athlone station will be ready in about 18 months. He mentioned that of 40,000 listeners, only one in ten purchased licences, but legislation is now passing through Parliament making payment of licence fees compulsory under penalty. It is hoped, he added, to use electric power available from the River Shannon for the Athlone station.

United States.—THE NATIONAL COMPANY.—With the advent of the new National Broadcasting Company, WEAF (New York) now becomes the centre of a system which comprises some twenty different transmitters in America. Several are of high power, says *World Radio*, and transmission from them is now being regularly and clearly received on this side of the Atlantic. The new company is in a position to link up with different cities in the United States and to relay programmes from any point in the system. For this reason listeners in the British Isles may pick up strange calls on wave-lengths which they have hitherto associated with certain well-known stations.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Aberdeen.—December 23rd. Northern Co-operative Society. 30-cwt. electric goods hoist for dairy at Berryden. Particulars from Messrs. Lawse & Allan, architects, 10, Bon-Accord Square, Aberdeen.

Australia.—MELBOURNE.—January 4th, 1927. P.M.G.'s Department. Bells and buzzers. (B.X. 2984.)*

January 18th, 1927. Switchboard cable. (B.X. 3013.)*

January 25th, 1927. Telephone transmitters and parts. (B.X. 3012.)*

Telephone receivers and associated parts. (B.X. 3041.)*

SYDNEY.—January 26th, 1927. New South Wales Government Railways. Electric railway car equipments, consisting of motors, control equipment, air compressors, pantographs and accessories (Spec. 1065). (A.X. 3810.)*

Dublin.—January 4th. Electricity Department. One surface condenser, with auxiliary plant. (See this issue.)

East Ham.—January 1st. Tramways Department. 10 double-deck bogie tramcars complete, or bodies and top covers with assembly of material; motor equipment; controller equipment; maximum traction swing bolster bogie trucks, magnetic track and hand brake equipment. (December 10th.)

Egypt.—CAIRO.—January 10th, 1927. Ministry of Public Works, Mechanical Department. Electrical generating plant for Giza. (B.X. 3079.)*

Fort William.—February 1st. North British Aluminium Co., Ltd. Water turbines (impulse type) and d.c. generators for the Lochaber water power scheme. (December 10th.)

Glasgow.—December 18th. Corporation. Electric lighting installation of the Possil housing scheme. Specifications from Mr. R. B. Mitchell, Corporation electrical engineer.

Huddersfield.—December 20th. Huddersfield Building Society. Electrician's work in conversion of warehouse premises into offices and caretaker's flat at Britannia Buildings, St. Peter's Street. Messrs. Stocks, Sykes & Hickson, architects, St. Peter's Street, Huddersfield.

Hull.—January 20th, 1927. Electricity Committee. Two 12,500-kW turbo-alternators and condensing plant. (See this issue.)

India.—December 21st. India Store Department. 280 miles (approx.) 110,000-V overhead transmission line. (October 29th.)
December 23rd. Inert cells. (See this issue.)
January 4th, 1927. 264,650 (approx.) copper bonds for track rails. (November 26th.)
January 21st, 1927. Circulating-water pumps, screens, and pump-house equipment, including delivery and erection in India. (December 10th.)
February 4th, 1927. 11 complete traction sub-stations and track-sectioning cabin equipments, including delivery and erection in India. (December 10th.)

London.—ISLINGTON.—January 21st. Electricity Department. Twelve months' supply of electrical and engineers' stores, including cables, meters, electrical sundries, lamps, transformers, and cable terminal, service, network and fuse boxes, circuit breakers, &c. (December 10th.)
CAMBERWELL.—Borough Council. Maintenance of electric lighting, heating, and power installations, telephones, &c.; 12 months' supply of electric lamps. Forms of tender from Mr. W. Bell, borough engineer and surveyor, Town Hall, Camberwell, S.E.5.

Manchester.—January 3rd, 1927. Electricity Committee. 33,000-V, 420-V, and 240-V switchgear. (November 26th.)

Meltham (near Huddersfield).—December 31st. Wiring, fittings, &c., required in the electric lighting of the Parish Church. Particulars from Mr. W. R. Carter, secretary, Church Council, Birchfield, Meltham.

New Zealand.—WELLINGTON.—January 4th, 1927. Public Works Department. Waikaremoana electric power scheme. Switchgear and transformers. (B.X. 2872.)* January 18th, 1927. Transmission line steel towers. (A.X. 3732.)* February 1st, 1927. Storage battery and booster. (B.X. 2937.)*
February 15th, 1927. Transformers for Waikato. (B.X. 2985.)*
Post and Telegraph Department. January 17th, 1927. Switchgear, cables, motor-generator sets, &c. (B.X. 3020.)*
January 19th, 1927. Electric bells and tumbler switches. (B.X. 3011.)*
January 31st, 1927. Government Railways. Electrical equipment for Otahuhu car and wagon workshops. (B.X. 3038.)*
February 14th, 1927. Switchgear, armoured cable and accessories, motor-generator sets, filament lamps and reflectors. (B.X. 3078.)*

Nottingham.—December 31st. Electricity Department. Two 30-in. electrically-driven pumps, one motor-driven twin booster, one 256-cell storage battery. (November 19th.)

Sittingbourne.—Electric lighting plant installation, including two 15-kW sets at Keycol Hill Hospital, for the Sittingbourne and Milton Regis Joint Hospital Board. Mr. E. Cecil Harris.

Southend-on-Sea.—December 20th. Electricity Department. 1,300 house-service meters. (December 10th.)

South Africa.—CAPE TOWN.—December 30th. South African Railways. Switchgear, cables, and transformers. (B.X. 3040.)*

Uruguay.—MONTEVIDEO.—January 19th, 1927. State Electricity Supply Works. 100,500 metres of wires and cables. (B.X. 3042.)*
January 24th, 1927. L.p. cables, telephone cables, branch and terminal boxes. (B.X. 3064.)*
January 28th. 923,000 meters, outdoor wires and cables. (B.X. 3063.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—SYDNEY.— Electricity Supply Committee. Recommended :—
H.p. and l.p. cables (£51,592).—Siemens (Australia) Pty., Ltd.
H.p. switch panels for 10,000-V indoor sub stations (£25,071).—Ferguson, Pailin, Ltd.
H.p. d.c. apparatus for cable testing (£3,545).—Australian General Electric Co., Ltd.
Two 100-ton cranes for Bunnerong power station (£14,734); economiser tubes (£605).—Babcock & Wilcox, Ltd.
Three 500-kVA, 33,000/10,850-V step-down transformers (£1,755).—Electrical Plant Manufacturers, Ltd.
Spare blade material for turbine (£1,313).—Metropolitan-Vickers Electrical Co., Ltd.
—Tenders.

Bradford.—Tramways Committee. Accepted:—
Demonstration railless-trolley vehicle (£1,425).—Associated Daimler Co., Ltd.

Brighton.—Tramways Committee. Accepted:—
Lead-covered feeder cables.

W. T. Glover & Co., Ltd. (Accepted.)	**£1,680**
Callender's Cable and Construction Co., Ltd.	1,704
British Insulated Cables, Ltd.	1,707
W. T. Henleys Telegraph Works Co., Ltd.	1,708
Standard Telephones and Cables, Ltd.	1,753

Burton-on-Trent. — Electricity Committee. Recommended :—
Mains extensions to Woodville (£19,830).—Johnson & Phillips, Ltd.

Douglas (I. of M.).—Electricity Committee. Accepted:—
Cleaning out battery cells.—Premier Battery Co.

Dublin.—Electric Lighting Department. Accepted:—
L.p. single-pole air circuit breakers.—J. G. Statter & Co., Ltd.
H.p. double- and triple-pole oil circuit breakers.—Sprecher & Schuh Co.
Change-over time switches.—Roper Bros.
—Irish Builder and Engineer.

East Grinstead.—Urban District Council. Accepted:—
Work in connection with the overhead line and cable to Sunnyside pumping station (£3,820).—Johnson & Phillips, Ltd.

Farnworth.—Electricity Department. Accepted:—
L.p. cables.—British Insulated Cables, Ltd.
Pillars, ground boxes, pathway frames and covers.—Lucy & Co.
Link boxes, pathway frames and covers.—Siemens Bros. & Co., Ltd.
V.i.r. and lead-covered cables.—Johnson & Phillips, Ltd.
Wiring accessories.—Lawrence & Nicholas; Sloan Electrical Co., Ltd.; W. O. Andrews; British Insulated Cables, Ltd.; General Electric Co., Ltd.

Glasgow.—Housing Committee. Recommended:—
Electrical installations at rehousing schemes in Duke Street and Govanhill (£2,103 for wiring at Govanhill and £140 for the lamps).—Kennedy, Robertson & Bain; (£844 for wiring at Duke Street and £99 for the lamps).—Mr. David Henderson.

Cleansing Committee. Accepted :—
Soot blowers at destructor works (Babcock & Wilcox type) (£1,602).—Heenan & Froude, Ltd.

Tramway Committee. Accepted :—
Trolley wire.—R. Johnson & Nephew, Ltd.; Thos. Bolton & Sons, Ltd.
Resistances for 50-h.p. motors.—Traction Equipment Co., Ltd.
Special trackwork.—Titan Trackwork Co., Ltd.; Thermit, Ltd.; Hadfields, Ltd.
Trolley bushes.—F. Mountford, Ltd.; British Insulated Cables, Ltd.
Cylinder for the main engine at the Subway power station (£575).—Yates & Thom, Ltd.

London.—HACKNEY.—Works Committee.
Renewal of electric-vehicle battery £239, less £33 for old battery.—Chloride Electrical Storage Co., Ltd. (Recommended.)

Electricity Committee.
Replacement parts for the economiser (£1,120).—E. Green & Son, Ltd. (Recommended.)

METROPOLITAN ASYLUMS BOARD.—Works Committee.
Repair of the electric clock system at Queen Mary's Hospital for Children (£179).—Synchronome Co., Ltd. (Accepted.)

ADMIRALTY.
Gasfilled lamps.—Metro-Vick Supplies, Ltd.; Siemens & English Electric Lamp Co., Ltd.

HAMMERSMITH.—Electricity Committee.

John Thompson Water Tube Boilers, Ltd.	£27,266 0 0*
Stirling Boiler Co., Ltd. (Recommended.)	**31,982 0 0**
Clarke, Chapman & Co., Ltd.	33,647 10 0
Babcock & Wilcox, Ltd.	33,633 0 0
Vickers Boiler Co., Ltd.	33,666 0 0
International Combustion, Ltd.	38,490 0 0

* Not in accordance with the Council's specification in several respects.

Spalding.—Urban Council. Accepted:—
Main transmission cable (£20,806); distributors and feeders (£9,827).—Pirelli-General Cable Works, Ltd.
Transformers and kiosks.—Foster Engineering Co., Ltd.
Meters.—Metropolitan-Vickers Electrical Co., Ltd.

Stafford.—Electricity Committee. Accepted:—
880 yd. cable (£251).—Callender's Cable & Construction Co., Ltd.

Wolstanton.—Staffs. Education Committee. Accepted:—
Installing electric lighting and power at the new boys' secondary school (£1,197).—E. M. Evans & Son, Ltd.

Woodford.—Urban District Council. Accepted:—
Installation of electric lighting at Council offices and fire station (£129).—County of London Electric Supply Co., Ltd.

Forthcoming Events.

British Electrical Development Association.—Friday, December 17th. Royal Society of Arts. 7.30 p.m. "Secrets of the Selling Art." Mr. G. S. Francis.

Birmingham Electric Club.—Friday, December 17th. Grand Hotel, Birmingham. Annual meeting.

Junior Institution of Engineers.—Friday, December 17th. 39, Victoria Street, S.W. 7.30 p.m. "Progress Methods Employed in a Large Mass-Production Motor Works." Mr. H. D. Glover.

Institution of Electrical Engineers (Tees-Side Sub-Centre).—Monday, December 20th. Cleveland Technical Institute, Middlesbrough. 7 p.m. "Some Electrical Problems." Mr. W. R. Cooper.

(North-Western Students' Section).—Saturday, December 18th. University Women's Union, Manchester. 7 to 11 p.m. Dance.

Notes.

The Rotary Convertor.—A paper on the above subject was recently read by Mr. G. B. Alvey before the London and other branches of the Association of Mining Electrical Engineers. To summarise the characteristics discussed, it may be said that a rotary convertor is eminently suitable for converting alternating current at approximately constant voltage and frequency to direct current; when the voltage range required on the direct current side exceeds about 15 per cent., it becomes necessary to add more or less undesirable auxiliary apparatus to the otherwise simple reactance controlled rotary. Considered as apparatus for transferring power from d.c. to a.c. systems, an "inverted" rotary convertor may be very suitably employed, provided that the voltage conditions and the relative sizes of the rotary and other a.c. generating plant

that is in operation on the system permit. As a means of providing a sole source of a.c. supply from a d.c. system, however, a rotary convertor is not ideally suitable, and in all cases where such operation forms an important part of the machine's duty it may be advisable to consider as an alternative the installation of some form of motor-alternator equipment. If the inverted duty is only occasional and the a.c. load does not fluctuate badly in either "magnitude" or power factor, or if the a.c. load to be carried is small as compared with the capacity of the machine, then a rotary convertor may possibly have the balance of advantages in its favour. Considerations of efficiency may often affect the choice of the type of plant for such a duty. The efficiency of a synchronous motor-alternator set will usually be at least 4 per cent. below that of the corresponding rotary convertor. If a machine is required to be employed on six days of the week in converting a.c. into d.c., but is required on the seventh day to convert d.c. to a.c., the saving of energy by the employment of a rotary convertor in preference to a motor-alternator may more than counterbalance the little inconvenience that may be caused by the instability of the former type of apparatus when running "inverted." If a machine is required to convert a.c. to d.c., but at the same time to provide a certain amount of wattless current for power-factor improvement, then again the synchronous motor-generator type of plant may offer advantages. It would be very expensive, for instance, to provide a rotary to operate at, say, 0.6 leading power factor; in any case, if independent control over the amount of power-factor correction were required, an induction regulator would require to be added to the equipment. Such instances need to be considered on their individual merits, the usual deciding factor being the total cost, which should include the cost of the energy lost in conversion and an allowance for cost of attendance and maintenance of the plant. In the past, difficulties have been experienced in starting rotary convertors with ease and certainty, but the modern rotary convertor is usually at least as easily started as the corresponding motor-generator. As regards cost and difficulty of maintenance, a modern, well designed and constructed rotary compares very favourably indeed with any other type of plant running at a corresponding speed.

Electricity on Farms.—The *Manchester Guardian* states that the city electrical engineer has reported to the Chester Corporation Electricity Committee that the Institution of Agricultural Engineering and the Development Commission have decided to proceed with the scheme for the supply of electricity to farms in the Corporation's area of supply, in accordance with the terms laid down by the Council. The Town Clerk has been instructed to prepare an agreement to be entered into between the Corporation and the Institution.

Electrical Contractors and the Electricity Bill.—At the annual dinner of the Newcastle Branch of the Electrical Contractors' Association, proposing the toast of "The Electrical Contractors' Association," Mr. J. Y. Fletcher said: "Contractors are a good barometer of the electrical weather: if you are 'set fair,' the wholesalers, the supply authorities, and even the poor down-trodden manufacturers are likely to be in the same position. What, then, are your prospects? I believe they are exceptionally bright. Nothing can prevent a boom in electricity during the next ten or twenty years—it must come—and a measure on the lines of the Electricity Bill was, in my opinion, inevitable. Personally, I hope the result will be standardisation, standardisation, and again standardisation, which will inevitably be accompanied by real large-scale mass production, bringing in its train such economies in production and distribution that the resultant demand will set us all working overtime to cope with it.

"Whatever the fate of the Electricity Bill, may I submit one word of advice—that is, do not let the contact established between the four sections of the industry during the recent discussions ever be broken.

"You are all familiar with the 'approved clause' finally adopted, but you may not be so familiar with what goes with it. You have:—

"(1) The Committee provided to settle what are the established retail prices, and

"(2) the declared policy of the I.M.E.A., which is as follows: 'The I.M.E.A. has satisfied the E.C.A. that it has no desire to interfere with the legitimate business of electrical contracting, but rather to assist it in every possible way.'

"I was present at all the meetings at which this 'approved clause' was discussed. From the outset the wider divergencies of opinion were between the E.C.A. and the I.M.E.A., possibly quite naturally so, but I welcome the opportunity of saying that the way in which the contractors' case was handled by your representatives first under the leadership of Mr. Tom Alger and later by Mr. Miles, their strength in debate when strength was necessary, their urbanity and wit when such methods were desirable, have raised the dignity and status of the E.C.A. in the eyes of all other sections of the industry—in none, I believe, more than in the eyes of the I.M.E.A. That is why I say, Bill or no Bill, let us all continue to support the four-cornered entente that has been created."

Introducing Metals into Electric Lamps.—It has been known for many years that certain alkali metals may be introduced, in a very pure form, into electric lamps by a method depending upon a sort of electrolysis through the glass walls. The method has been described recently and applied to certain physical problems, such as the investigation of the photo-electric effect of pure sodium. The lamp into which it is wished to introduce, say, sodium is placed with its lower part in molten sodium nitrate contained in a metal vessel (aluminium is a very suitable metal for the container to be made of); the sodium nitrate is maintained molten at a temperature of about 350 deg. C. The lamp filament is made to function as usual and a source of potential of some 200 or 300 volts is connected between the positive terminal of the lighting circuit and the metal container; as a rule a few milliamperes flow in the circuit from the metal container to the positive end of the filament. According to *Experimental Wireless and the Wireless Engineer*, the inner surface of the glass is bombarded by the electrons from the filament and becomes negatively charged, forming the cathode. The outer surface of the glass is positively charged from the auxiliary circuit potential and constitutes the anode. There are, of course, many free sodium ions in the molten nitrate, and under the electric field across the glass wall they migrate (since they are positively charged) to the cathode, that is, to the inner surface of the glass, and are deposited there or vaporised into the lamp. The action may be progressive in such a way that the sodium of the glass is actually transferred inwards, whilst sodium from the molten nitrate takes its place. After the action has proceeded for a short time, the sodium vapour within the lamp gives rise to a discharge of a very typical yellow colour. In a few hours sufficient sodium may be introduced to produce a mirror of the metal on the inside of the glass. If the lamp is made of lead glass it frequently becomes blackened, but even sodium glasses become brown, due to a deposit of sodium in the colloidal state. In a similar manner, but less readily, potassium may be introduced if molten potassium nitrate is substituted for the sodium nitrate. The method can be employed for the introduction of very pure sodium or potassium into thermionic valves, and it is certainly a subject which merits further study.

New Swedish Refrigerators.—Two new inventions of refrigerating apparatus for household purposes have been made by Swedish engineers, one by Mr. Risberg at the Baltic factories, Soedertaelje, on the compression principle, the other by Mr. A. J. Munters, father of the inventor of the refrigerator manufactured by Aktiebolaget Elektrolux. The Munters invention is constructed on an entirely new principle, but patents have not yet been definitely taken out. Both inventions are said to be quite completed and to have passed very satisfactory trials.—*Reuter's Trade Service* (Stockholm).

Railway Electrification in the United States.—A project now under way on the Great Northern Railway, U.S.A., has attracted attention because of one of the pioneer systems in America (a three-phase system) giving place to new work. The present undertaking involves the revision of the original electrification between Tye, Washington, at the western end of the Cascade Tunnel and its eastern portal, and extension westward to Skykomish, Washington. The electrified line will thus be increased from four to 24 miles of main-line trackage, exclusive of yards. The project constitutes what is reported to be the first step in a programme that will include 96 miles of main-line, *via* a new tunnel, from Gold Bar to Wenatchee. In order to secure the advantages of alternating-current transmission and trolley and of direct-current traction motors, the motor-generator type of locomotive was chosen, drawing power from an 11,000-volt, single-phase, 25-cycle trolley wire. The original electrification, which is now undergoing modification, was installed in 1909 on the 6,600-volt, a.c. three-phase, 25-cycle system, with a double overhead catenary trolley wire.

The two new Baldwin-Westinghouse electric locomotives for the Great Northern railroad each consists of two cabs, identical mechanically and electrically; each one is fully equipped to operate alone, and present plans are to operate two cabs as a road locomotive. Each locomotive weighs about 715,000 lb., is 94 ft. 4 in. long, and has a continuous rating of 88,500 lb. tractive effort at 15.5 m.p.h.; the maximum allowable speed is 37.5 m.p.h., and maximum rating is almost 7,000 h.p. These two-unit locomotives are claimed to be the most powerful of their type ever built; one of them has been delivered at Skykomish and the other was to be completed in December. The Great Northern Railway has contracted with the Puget Sound Power and Light Co. to supply all power, and two 44-kV railway transmission lines, the trolley, and signal lines will all be carried on single poles along the right-of-way. Careful consideration has been given to possible interference with communication lines due to the single-phase system. The d.c. signal system will be changed to a.c., 60 cycles, with 6,600-volt transmission. Telegraph and telephone lines *en route* will undergo general "revamping," using, if necessary, cables, or removing them from the right-of-way entirely; local telephone lines heretofore adjacent to the right-of way will be removed to a convenient distance therefrom to avoid inductive trouble. Distance as the most effective remedy has been the general basis on which the problem of inductive interference has been considered. Metering presented some interesting problems owing to the contract calling for the simultaneous measurement of demand at two widely-separated points. In addition, it is necessary to take into account power fed back into the power company's system by the railway's Tumwater hydro-electric plant and by the locomotives when regenerating. Power will be measured by two three-phase ratchet meters at each point, and demands will be measured by graphic meters to obtain simultaneous records at the two points. As all power taken by the railway company from the 110-kV line of the power company will pass through

frequency changers, driven by synchronous motors, it will be possible to maintain unity power factor, or even a leading power factor if desired. Simultaneously with the rehabilitation and extension of the original electrical section, a new tunnel through the Cascade Mountains was begun, and, when completed, this will be the longest railway tunnel in America, seven and three-quarter miles. The present line crosses the divide at an elevation of 3,385 ft. above sea level, and as heavy snowfall reaches a maximum of 670 inches each season, it is difficult and expensive to keep the line open for operation. The new tunnel line will shorten the right-of-way more than 7½ miles, eliminate nearly six complete circles of curvature, and will escape most of the severe snow trouble, as its elevation will be 500 ft. lower.

Heating and Ventilating Engineers' Competition.—The Institution of Heating and Ventilating Engineers offers the following prizes for papers on subjects connected with heating and ventilating, during 1927: £10 10s., the British Commercial Gas Association premium; £6 6s. and £4 4s., Sirocco premiums; £5 5s., London premium. Any subject may be chosen, and a copy of the list of subjects prepared by the Institution may be obtained on application to the Secretary, 38, Victoria Street, London, S.W. The papers must be posted to the Competition Committee, c/o the Secretary, not later than May 1st, 1927.

Eye Protection for Electric Welding.—The use of goggles or glasses for protecting the eyes of workmen engaged in electric or acetylene torch welding work is mandatory in the United States. The U.S.A. Bureau of Standards has been carrying out some experiments in connection with such glasses, and reports that the brown glass usually employed for protection against ultra-violet rays does not afford metallurgical-furnace workers satisfactory contrast between the melt and the furnace walls. The Bureau has developed a blue glass which, it is claimed, affords the proper contrast, and at the same time cuts out the ultra-violet radiation.

Big Diesel-Electric Vessels.—There has lately been a definite trend towards the employment of oil engines for the propulsion of ferry boats. Recently the *Dolores de Urquiza* arrived at Buenos Aires and started service on the River Parana, and in April the Danish State Railways will take delivery of a big and fast train ferry to connect Nyborg and Korsör, on the main Copenhagen-Esbjerg line. Other important new ferry ships are under construction in Europe, also in America, whilst six motor ferry boats have just been ordered for service in San Francisco Harbour, and these will be, says the *Motor Ship*, the largest of their type yet constructed. Diesel-electric propulsion is to be utilised, and the craft are for the Southern Pacific Railway and the North-Western Pacific Railroad Co., the former operating three between San Francisco and Oakland, and the latter the remainder from San Francisco to Sausolito. Each will carry about 80 or 90 motor-cars, in addition to 500 passengers, and they are designed for a speed of 14 knots. They will be 256 ft. in length overall, with an overall beam of 62 ft.; their draught will be 11 ft. 3 in. Three are to be constructed by the Union Iron Works, two by the Moore Dry Dock Co., and one by the General Engineering and Dry Dock Co., whilst the New London Ship and Engine Co. will supply all the engines, and the Westinghouse Electric and Manufacturing Co. and the General Electric Co. of America the electrical plant. The vessels will be double-ended, and the two propellers will be driven by separate 1,250-b.h.p. double-armature electric motors located in the engine room. The generating plant will comprise four 450-b.h.p. Nelseco-M.A.N. engines coupled to 275-kW generators and 40-kW exciters, running at the moderate speed of 230 r.p.m. It is anticipated that the first will be placed in service in the spring; it is understood that the cost of each is over $600,000. Also for service at San Francisco three Diesel-electric ferry boats are being built for the Golden Gate Ferry Co. They will have two 950-b.h.p. electric motors, each driving a propeller at 180 r.p.m., the voltage of supply being 750. Three 400-b.h.p. Ingersoll-Rand engines will be installed, each coupled to a 275-kW dynamo. There were launched towards the end of October two of six Diesel-electric ferry boats, which are being built by the American Brown, Boveri Electric Corporation, for Electric Ferries (Incorp.) for service at New York. In each of these two 500-h.p. electric motors running at 180 r.p.m. are installed, the vessels being double-ended; power is supplied from Diesel-driven generators. Thus there are now under construction in America 15 large Diesel-electric ferry boats.

Vitality of Telephone Equipment.—A remarkable instance of the ability of modern telephone plant to withstand the most adverse conditions has occurred in Lancashire. According to the *Post Office Electrical Engineers' Journal*, a private automatic branch exchange equipment installed in the basement of a cotton mill was inundated consequent upon an exceptionally severe thunderstorm. The charging machine, ringing machine, one battery of secondary cells, and practically the whole of the automatic equipment were submerged. When the storm had abated a fire engine pumped the water out of the basement, which had been filled to a depth of about 4 ft., and, besides being soaked, the apparatus was found, on removing the relay covers, to be smothered with a film of slime and green rubbish. The idea of salving the equipment was formed, and mud remaining after washing with a hose was removed from the relays and cable forms by the use of Pyrene fire extinguishers, and all surfaces were wiped with clean cloths. The machines, after further washing and wiping, were dismantled and placed in the boiler house to dry. The cells were emptied, cleaned, and refilled with acid and, pending the availability of the charging dynamotor, they were charged through a resistance direct from the mains. The ordinary heating apparatus of the room was found to be quite inadequate if the water were to be evaporated before the plant was damaged by corrosion. A motor desiccator, a number of blow lamps, and as many electric radiators as could be obtained were brought into use. The most efficient way of removing the moisture, however, was found to be the use of "vacuum cleaners" reversed and used as blowers, with the suction sides arranged to draw the heated air from blow lamps through metal tubes in which were placed bags of calcium chloride. The water standing on the relay springs and other parts was removed by the use of blotting paper and the cable forms that had been submerged were opened and boiled out with wax. All the relay armatures were removed and cleaned, every contact throughout the equipment was cleaned, and every spring was tested for tension and adjusted if necessary. Immediately following the flood notice had been given to the manufacturers (the Relay Automatic Telephone Co.) of the possibility of a demand being made for plant to replace the damaged equipment, but, thanks to the quality of the original apparatus and to the initiative and the persistent efforts of the staff, the installation, as it stood, was restored to service on the morning of the seventh day after the flood. Six hundred relays, one set of secondary cells, one charging machine, one ringing machine, and the associated wiring and cabling were submerged, but the whole of the plant was salved and is still in use, with the exception of one choke coil and three transformers in the ringing equipment and eight relays and four condensers in the automatic switching equipment. Twelve months have elapsed since the flood, and the occurrence of faults in the automatic apparatus has been at the rate of one fault per circuit per annum, a figure which, although about four times as great as the normal for this type of installation, cannot be regarded as high in the circumstances described.

Electric Welding on Board Ship.—A demonstration was recently given on board a steamer in dock at Antwerp by the Industrie en Handelsmaatschappij v.h. Horms & Co., of Amsterdam, of a new system of electric welding devised by M. J. H. Ezendam, the director of the company. Hitherto, in the case of a fracture in a ship's boiler, the repair had to be effected at the next port of call, necessitating considerable delay. By the new Ezendam system it is claimed that such welding work can be carried out electrically by apparatus carried on the ship itself and in a minimum amount of time.

Appointments Vacant.—Charge engineer for the Lancashire United Transport and Power Co. Fitters for rolling stock, electrical work and electric lifts, linemen and substation attendants for the Post Office (London) Railway. Plumber-jointer for the Clacton-on-Sea Urban District Council Electricity Department. Assistant engineer for the Wimbledon Corporation Electricity Department. Assistant electrical engineer (£400) for mining cable work in India. (See our advertisement pages to-day.)

Tar for Electrodes.—In the course of a discussion at the Manchester Tar Conference on November 26th, reported in *The Gas World*, Mr. G. B. Brook (chief chemist, British Aluminium Company) said he came to put in a plea for an industry which was rather an exceptional one in relation to that Conference, *viz.*, the manufacture of electrodes for electrical purposes. The transition from the horizontal to the vertical retort system was a very serious problem for the electrode industry, because it was impossible to make carbons of the same quality from vertical-retort coke as from horizontal-retort coke. The manufacture of aluminium and the development of the electric furnace were rapidly growing, and he hoped the gas industry would bear this in mind and endeavour to help a sister industry in some way. What was required was a material which would give some residual carbonaceous binding between the grains. This was also bound up with the coke-oven industry, because what was wanted between the grains of the electrode was a carbon of the type of a metallurgical coke, *viz.*, a material which should not be easily oxidised and therefore would remain as a binder between the grains during the operation of the process.

A point of great importance was what was termed in the carbon electrode industry synthetic mixtures of tar and pitch. They looked with very grave fears on those who provided these mixtures of tar and pitch made from too-far-distilled tars. That was hardly fair to the electrode industry. The electrodes were not made entirely of tar, so that it would be possible to get a very good coke by carbonising the tar. The electrodes were made with 18 or 20 per cent. of tar as a binder, or tar and pitch. The process of manufacture was to grind the coke, and the whole material was calcined at a temperature of from 1,200 to 1,300 deg. C. in a reducing atmosphere, it being surrounded by carbon material to prevent burning. This was an increasing business, and in these post-war times he thought each industry should help the other as far as possible.

Dr. E. W. Smith suggested that the requirements of the electrode industry could be met by making arrangements with a particular gasworks to make what was necessary. There was a works in this country which had been continuously—except during the past month, due to the coal stoppage—putting oils into the top of a vertical retort and completely cracking those oils, and he could not see that any difficulty

would arise, where a special material was required such as had been referred to, in still further cracking vertical retort tars for special purposes. The amount of coal carbonised nowadays in different types of vertical retorts was well over 50 per cent. of the total coal carbonised in the gas industry. Vertical retort tar had come to stay, and the tar industry had been and was adapting itself to the new type of tar.

The Electrical Trades Benevolent Institution.—At the annual ball organised by the North-East Coast Section, Mr. R. E. Robson informs us, Mrs. M. Sherriff, of 39, Queen's Drive, Monkseaton, received a coupon attached to her receipt for her subscription, giving the time at which the gold watch stopped, namely 9-54-0. Strange to say, the watch was taken out of the sealed box by the Lady *Sheriff*, of Newcastle-upon-Tyne, and the time at which the box was opened was 9.55 p.m. Mrs. Sherriff is therefore entitled to purchase the watch for the sum of 1s. The total amount realised in connection with the gold watch was £121 5s. 0d.

Electrical Association for Women.—A party of members of the Manchester District Branch of the above Association spent a very enjoyable afternoon at the electrical showrooms of the Manchester Corporation in St. Ann Street on December 9th, when Mr. C. H. Rayner, sales manager, talked to them on the advantages of the special domestic rate and demonstrated the use of various types of electrical apparatus which could be used in the home.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETINGS SECTION.—At the informal meeting held on December 6th, Mr. J. F. Shipley was in the chair, when Mr. Ll. B. Atkinson opened a discussion on "The Trend of Electrical Developments in the U.S.A. and Canada." Mr. Atkinson said the impressions he formed during his recent visit were confined to a somewhat limited area, as he did not go to California or the Western States, but he saw the entirely different systems of the industrialised American States with coal fuel stations, and the more scattered areas of water-powered Canada.

The most striking features of the electricity supply in the U.S.A. are first, the tremendous concentration of distribution within small localities, and next, the remarkable concentration of electricity supply duties into the hands of a few public utility companies. He instanced the single area of New York with a load of 800,000 kW, distinct from the Brooklyn load of 250,000 kW; and the strikingly compact demand from the huge sky-scraper offices with as many as 20,000 or even 40,000 people in one building, this concentration being repeated in the enormous apartment houses. As the supply is generally by 3-wire 230/115 V, the streets are often congested with cables, and this has produced difficulties that are not yet solved.

The general domestic load does not seem to have advanced as far as in some European countries, and this is partly to be attributed to the cost of electricity which, after allowing for the difference in money values, is not so cheap as in many parts of England.

In Canada the water-power is all scheduled and State-controlled, while the huge output of the State of Ontario is sold at less than cost to almost every voter in the State, so that political annihilation awaits the politician who would introduce an economic price.

At Niagara the original turbines installed some thirty years ago are still in service side by side with the new monster generator of 70,000 kW at 160 r.p.m.

Colonel R. E. Crompton, C.B., said he recently went to the U.S.A. expecting to learn, but he was disappointed, for the problems that were so vital to us did not seem to concern them over there. Our careful and delicate control of capital costs did not exist in the U.S.A., and their wasteful use of electric lighting had no parallel. He praised the system of electric welding which had been developed, and which he thought was very considerably in advance of our methods.

Mr. A. R. Everest described the remarkable applications of electric motors to the driving of large and small ships of all kinds.

Royal Institution.—The Christmas course of six lectures for juveniles will be delivered by Professor A. V. Hill, on "Nerves and Muscles: How we Feel and Move," commencing on December 28th, at 3 p.m. On Tuesdays, at 5.15, beginning on January 18th, amongst other items, there will be two lectures by Professor R. Whytlaw-Gray on "Smokes as Aerial Disperse Systems," two by Dr. G. Shearer on "X-rays and the Chemical Molecule," and two by Professor J. W. Cobb on "Some Properties of Coke."

There will be three lectures on Thursday afternoons by Sir William Bragg on "Acoustical Problems Treated by Lord Rayleigh."

On Saturday afternoons at three o'clock there will be four lectures by Sir Ernest Rutherford on "The Alpha Rays and their application to Atomic Structure." The Friday evening meetings will begin on January 21st, when Sir William Bragg will deliver a discourse on "Tyndall's Experiments on Magne-Crystallic Action." Succeeding discourses will probably be given by Captain T. L. Eckersley, Professor C. T. R. Wilson, Sir Ernest Rutherford, and others.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. HARRY WRIGHT, B.Sc., head of the Physics and Electrical Engineering Department of the Dewsbury Municipal Technical College, who has been on the staff there for 20 years, has been appointed Principal of the College out of a final list of 13 candidates. There were originally over 80 applicants for the post.

The Dover Town Council has promoted Mr. R. SPENCER to be charge engineer at the electricity works.

The Wakefield Electricity Committee has decided that Mr. R. O. SEVILLE shall be promoted from the position of constructional engineer to that of deputy city electrical engineer, and that the designation of the present power station superintendent shall be altered to power station assistant.

Capt. E. MURRAY HARVEY, O.B.E., Commercial Secretary at Belgrade, is on a visit to this country and will be available for interviews with British firms interested in trade with Jugo-Slavia until December 24th. Interviews can be arranged by communication with the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

Mr. J. C. HODSON, late sales manager of Electron Co., Ltd., has joined the sales staff of the Mullard Wireless Service Co., Ltd.

Mr. R. W. GRUBB, borough electrical engineer of Dewsbury, has just been elected Worshipful Master of the St. John's Lodge of Freemasons, Dewsbury.

Capt. J. COXON, M.I.E.E., of the Post Office Engineering Department, has been transferred from London to Birmingham as power engineer for the North Wales District, with offices at 42, Paradise Street, Birmingham.

Mr. JOHN A. CRESSEY, M.Am.I.E.E., who has held the position of control engineer to the South Wales Electrical Power Distribution Co. for 3½ years, has been appointed charge engineer to the Shanghai Municipal Electricity Department.

Obituary.—HERR DOCTOR.—The death recently occurred in Vienna, at the age of 56 years, of Herr Ernst Doctor, chief of the transformer designing office of the Austrian Siemens-Schuckert Co. The deceased was well known for his work in connection with transformers and was responsible for the design of the 120,000-V transformer plant for the Vienna municipal hydro-electric power station.

MR. ROGER W. WALLACE.—The death occurred suddenly on Monday, in London, of Mr. Roger William Wallace, K.C. Mr. Wallace, who was 73 years of age, was for many years interested in electrical affairs. In addition to following his legal pursuits, he was prominently connected with various electricity supply undertakings in London, while chemical and engineering industry and patent law also occupied his attention. His direct connection with electrical enterprises was at one time more active than it had latterly been. He was an Associate of the Institution of Electrical Engineers, and in 1891 and a number of other years was a Member of Council. Down to the last he was a director of the Kensington and Knightsbridge Electric Lighting Co., Ltd., and of the Kensington and Notting Hill Electric Lighting Committee, also a director of the Aron Electricity Meter, Ltd. Many years ago he was a director of the Westminster Electric Supply Corporation, with which he was identified from its inception. He was also the first chairman of the British Aluminium Co., Ltd., presiding at its first ordinary meeting in 1896, at which Lord Kelvin seconded the adoption of the report. Mr. Wallace was the first chairman of the Royal Automobile Club.

LORD EMMOTT.—The sudden death of Lord Emmott, which occurred on Monday last removes from our midst one who rose to great heights of public usefulness, both in industry and in politics. Any direct relationship into which he was ever brought with the electrical industry was through his position as Director of the War Trade Department—one of the most difficult of the special departments which early in the war became so necessary. He was head of it from the year 1915 until 1919. His personal industrial interests were mainly textiles and textile engineering, but he was a director of other concerns, including the National Boiler and General Insurance Co. He was born in 1858, and was made a peer by Mr. Asquith in 1911.

New Companies Registered.

Electric Driers, Ltd. (218,003).—Private company. Registered December 6th. Capital, £2,000 in £1 shares. The objects are to acquire the benefit of certain existing inventions in relation to the drying or curing by electrical process of tea, coffee, tobacco, cinchona, cocoa, rubber and other products, to manufacture and deal in plant or machinery in connection therewith, &c. The first directors are:—B. M. Drake, 36, Grosvenor Gardens, S.W.1, electrical engineer (company director); W. F. Lloyd, 11, St. James' Place, S.W.1, electrical engineer with Armstrong, Whitworth & Co., Ltd.; M. G. Drake, 36, Grosvenor Gardens, S.W.1, company director; R. H. M. Drake, 36, Grosvenor Gardens, S.W.1, company director. Solicitors: Wigan and Co., Norfolk House, Victoria Embankment, W.C.2. The registered office is at 36, Grosvenor Gardens, S.W.1.

Llanidloes Electric Light Co. (1926), Ltd. (218,075).—Private company. Registered December 9th. Capital, £1,000 in £5 shares. Objects: To carry on the business indicated by the title. The first directors are:—E. R. H. Turner, Llys Evrog, Llanidloes, Montgomery; R. T. Morgan, Vaenor Park, Llanidloes; O. J. Meredith, The Garage, Long Bridge Street, Llanidloes; and E. T. Bunford, Flashfryd, Llanidloes. Qualification, 10 shares. Secretary: E. T. Bunford. Solicitor: M. Jenkins, Llanidloes. Registered office: The Garage, Long Bridge Street, Llanidloes.

Oxford Radio Supplies, Ltd. (218,079).—Private company. Registered December 9th. Capital, £100 in £1 shares. Objects: To carry on the business of a radio-telephone and telegraph company, &c. The first directors are:—J. R. Wilkins, 4, Chalfont Road, Oxford; C. Eippon, Springfields, Abingdon; A. H. Herbert, High Street, Oxford; H. Lawley, 20, Farndon Road, Oxford; A. H. Shirley (joint managing director), Blen Cottage, London Road, Headington, Oxon. Qualification, 1 share. Secretary: H. Lawley. Solicitors: Linnell and Murphy, Tower House, Carfax, Oxford. Registered office: 29, Queen Street, Oxford.

Reproduction, Ltd. (218,052).—Private company. Registered December 8th. Capital, £6,000 in £1 shares. To acquire lands, &c., with a view to manufacturing and dealing in gramophones, phonographs and all kinds of loud-speaking apparatus, radio receivers, and any article adapted for sound reproduction and amplifying, &c. The subscribers (each with one share) are:—R. May, 5, Dysart Street, E.C.2, manufacturer and merchant; Slade, 20, Lendore Road, S.W.11, secretary. R. May is the first managing director. Qualification of directors, 100 fully paid shares. Remuneration as fixed by the company. Solicitors: Braund & Hill, 6, Gray's Inn Square, W.C.1.

S. Kalisky (Aldgate), Ltd. (218,058).—Private company. Registered December 8th. Capital, £1,000 in £1 shares. Objects: To carry on the business of radio merchants, electricians, radio and mechanical engineers, manufacturers and workers of and dealers in fancy goods, toys, &c. The first directors are:—H. L. Levy, 40, Firsby Road, Stoke Newington, merchant; J. Kay, 152, Kyverdale Road, Stoke Newington, merchant. Qualification, 100 shares. Remuneration as fixed by the company. Secretary: A. E. Hartley. Solicitor: R. Livermore, 87, Bishopsgate, E.C.2. Registered office: 75, Aldgate High Street, E.1.

J. W. Scott & Co., Ltd. (218,048). — Private company. Registered December 8th. Capital, £2,000 in £1 shares. Objects: To carry on the business of electrical, radio and general engineers, founders, smiths, machinists, general haulage, shipping and forwarding contractors or agents, &c. The first directors are:—J. W. Scott, 50, Obelisk Road, Southampton; W. J. Steele, address not stated. Qualification, £1. Remuneration (except managing director, if any) as fixed by the company.

Steel Tube and Conduit Co. (Middlesbrough), Ltd. (218,083).—Private company. Registered December 9th. Capital, £5,000 in £1 shares. Objects: To acquire the business at Lower Commercial Street, Middlesbrough, recently belonging to and carried on by the Middlesbrough Steel Tube and Conduit Co., Ltd., the goodwill, rights and interests of which are vested in A. Chapman, of Ryder Gardens, Roundhay, Leeds, and to carry on the business of manufacturers of and dealers in conduit, and iron and steel tubes of all kinds, and fittings used in connection therewith, manufacturers of and dealers in electrical and mechanical appliances, switches, switchboards, &c. The subscribers (each with 100 shares) are:—H. E. Woolley, 5, Albion Terrace, Saltburn-by-the-Sea, engineer; W. H. Mill, 58, Castle Street, Edinburgh, solicitor. The first directors are not named. Qualification, 100 shares. It is intended that the company shall forthwith create and issue £4,000 debentures secured over the whole of the assets. Solicitor: W. H. Mill.

The Metropolitan Electric Cable and Construction Co., Ltd. (218,078).—Private company. Registered December 9th. Capital, £75,000 in £1 shares. Objects: To adopt an agreement with David Dunn Warren, explosives merchant; W. Brown, of W. Brown & Co., Engineers, Ltd., electrical engineers; and James Miller, stockbroker, all of Glasgow; and to carry on the business of manufacturers of electrical wires and cables and all manner of appliances and apparatus for the generation, supply, use and control of electrical power, including electric motors and brakes, and in particular that of manufacturers of and dealers in the various types of wire and electrical cable hitherto manufactured by Fuller's United Electric Works, Ltd., under the patents, designs and trade marks formerly possessed by that company. The first directors are:—D. D. Warren, Westbourne House, Kelvinside, Glasgow (governing director of Hunter and Warren, Ltd., explosives merchants, 119, Waterloo Street, Glasgow); W. Brown, Haytor, Busby Road, Giffnock, Renfrewshire (director of W. Brown & Co., Engineers, Ltd., 89, Douglas Street, Glasgow); J. Miller, 46, St. Andrew's Drive, Pollokshields, Glasgow. Qualification, 500 shares. Remuneration (including managing directors), £100 each per annum. The directors' borrowing powers are restricted to £30,000. With the sanction of an extraordinary resolution of the company, the directors may borrow beyond that limit. Solicitors: Moncrieff, Warren, Paterson & Co., 45, West George Street, Glasgow. Registered office: Fuller's Works, Chadwell Heath, E.

Solaflex, Ltd. (217,922).—Private company. Registered December 2nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of dealers in and manufacturers of all apparatus, appliances and plant required for or capable of being used in publicity and advertising of all kinds, &c. The subscribers (each with one share) are:—W. Stanley Evans, 18, Cheyne Row, Chelsea, S.W.3, C.A.; G. M. Botting, St. Anthony, Hook Heath, Woking, C.A. The first directors are to be appointed by the subscribers. Qualification, £1. Remuneration as fixed by the company. Solicitors: Joynson-Hicks & Co., Lennox House, Norfolk Street, W.C.2. Registered office: 12, Grosvenor Gardens, Westminster, S.W.1.

R. A. Lister Recreation and Social Club, Ltd. (218,008). —Registered as a "public" company on December 6th with a nominal capital of £6,000 in 14,000 6 per cent. cumulative preference and 10,000 ordinary shares of 5s. each. The objects are to promote and encourage all kinds of athletic games, sports and social recreation by means of a recreation and social club for the employés of R. A. Lister & Co., Ltd. The minimum cash subscription is 7 shares. The first directors are:—Sir Robert A. Lister, Kt., C.B.E., "The Towers," Dursley, Glos., chairman (chairman of directors of R. A. Lister & Co., Ltd.); C. P. Lister, 127, Piccadilly, W. (director of R. A. Lister & Co., Ltd.); R. B. Lister, "The Elms," Stone, Glos. (director of R. A. Lister & Co., Ltd.); W. C. Morgan, "Margam," Kingshill Road, Dursley, works accountant; C. W. Hicks, 2, Roseberry Terrace, Dursley, iron moulder. Solicitors: Wansbroughs, Robinson, Tayler & Tayler, Lion Chambers, Broad Street, Bristol. The registered office is at The Priory, Dursley, Glos.

R. L. Irvine (1926), Ltd. (214,390).—Private company. Registered in Edinburgh November 30th. Capital, £300 in £1 shares. Objects:—To acquire as from October 31st, 1926, the businesses (a) of R. L. Irvine, merchants and agents, (b) of Currie, Brown & Co., merchants and agents, (c) of Electric Power Units, merchants and agents, and (d) of J. D. Woodside & Co., wholesale stationers, all carried on at 47, Oswald Street, Glasgow. The directors are:—J. D. Woodside, 12, Earlspark Avenue, Newlands, Glasgow, merchant; J. Woodside, 12, Earlspark Avenue, Newlands, Glasgow, merchant. Registered office: 47, Oswald Street, Glasgow.

A. Melville Sidley, Ltd. (217,928).—Private company. Registered December 3rd. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in wireless and electrical instruments, apparatus, accessories, machines and materials, electricians, electrical engineers, &c. The first directors are:—A. M. Sidley, A.M.I.M.E., 50, Churchill Avenue, Foleshill, Coventry, engineer; Mrs. M. Sidley, 50, Churchill Avenue, Foleshill, Coventry. A. M. Sidley is chairman and permanent managing director, subject to holding 50 shares. Qualification of other directors, 1 share. Registered office: 320, Foleshill Road, Coventry.

Burke & Co., Ltd. (217,971).—Private company. Registered December 4th. Capital, £1,000 in £1 shares. Objects. To acquire the business of electrical engineers lately carried on by B. Burke and W. Burke, trading as Burke & Co. at 55, Stamford Street, Old Trafford, Manchester; and to carry on the same and the business of electricians, wireless engineers, motor lighting specialists, manufacturers of and dealers in engines, electrical fittings, &c. The first directors are:—B. Burke, 55, Stamford Street, Old Trafford, electrical engineer; W. Burke, 55, Stamford Street, Old Trafford, electrical engineer (both permanent). Qualification, £250 shares. Remuneration as fixed by the board.

Pianiste Manufacturing Co., Ltd. (218,104).—Private company. Registered December 10th. Capital, £1,000 in £1 shares. Objects: To adopt an agreement between W. F. Dunn, of the first part, S. L. Forbes and C. A. McKeand of the second part, and The Radio Development Co. of the third part, and to carry on the business of a wireless telephone, telegraph and electric light, heat and power supply company, &c. The first directors are:—S. L. Forbes, 10, Horbury Crescent, Notting Hill, W.; C. A. McKeand, 1, Longridge Mansions, Earl's Court, W.; W. F. Dunn, 9, Woodland Terrace, Charlton, S.E.7. Solicitors: Simon, Haynes, Barlas and Ireland, 117-123, Great Portland Street, W.1. Registered office: 15, Margaret Street, W.1.

Official Returns of Electrical Companies.

Burndept Wireless, Ltd.—Debenture dated November 26th, 1926, to secure £50,000 and premium of 6 per cent. constituting a specific charge on freehold and leasehold properties at Willesden and Blackheath, and a floating charge on the remaining assets and undertaking, subject to an existing charge in favour of the company's bankers; the company is at liberty to borrow from its bankers in priority to the debenture further sums not exceeding with the sums already borrowed £40,000. Holders: Johnson and Phillips, Ltd., 12, Union Court, Old Broad Street, E.C.2. (The company has power to redeem the debenture at a premium of 3 per cent. by three months' notice terminating on June 30th or December 30th in any year on or prior to June 30th, 1928.)

Neutron, Ltd.—Issue on May 19th, 1926, of £400 debentures, part of a series already registered. (Notice filed November 24th.)

Debenture dated November 5th, 1926, to secure £3,150, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: P. G. Marr & Co., Ltd.

Satisfaction in full on November 5th of debentures dated April 12th to May 19th, 1926, securing £2,550.

Unique Wireless Co., Ltd.—E. E. Jennings, of 3, Baker Street Chambers, Baker Street, W.1, was appointed receiver on November 23rd, under powers contained in debenture dated July 16th, 1926.

Mills, English & Co., Ltd. (Old Company).—J. H. Bateman, of 46, Waterloo Street, Swansea, ceased to act as receiver or manager on November 30th, 1926.

Unity Lamp and Accessories, Ltd.—Particulars filed of £1,700 debentures authorised October 29th, 1926, charged on the company's undertaking and property, present and future, the whole amount being now issued.

St. Austell and District Electric Lighting and Power Co., Ltd. Capital, £20,000 in 13,000 preference and 7,000 ordinary shares of £1 each. Return dated August 6th, 1926. 13,000 preference and 6,700 ordinary shares taken up. £19,532 15s. paid (being £1 per share on 13,000 preference and 6,077 ordinary, and 15s. per share on 623 ordinary shares). Mortgages and charges, £20,900.

Holmes & James, Ltd.—G. T. W. Coleman, of 13, Temple Street, Birmingham, ceased to act as receiver or manager on November 22nd, 1926.

Gilbert Gilkes & Co., Ltd.—Particulars filed of £1,800 debentures authorised October 11th, 1926, charged on the company's property, present and future, including uncalled and unpaid capital, the whole amount being now issued.

Woking Electric Supply Co., Ltd.—Satisfaction in full on May 2nd, 1914, of charge dated December 2nd, 1913, securing all moneys due or to become due from the company to Barclay's Bank, Ltd. (Notice filed November 29th, 1926.)

Isle of Thanet Electric Supply Co., Ltd.—Satisfaction to the extent of £2,816 on September 30th, 1926, of charges dated January 18th, 1902, and September 15th, 1924, securing £150,000 debenture stock each.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

City of London Electric Lighting Co., Ltd.

As briefly recorded in our last issue, the directors have issued a report and statement of accounts as at December 31st, 1925. This report explains that for reasons for which the company is in no way responsible, the directors are not yet able to present a balance sheet showing the financial position of the company under the London Electricity (No. 1) Act, 1925, because the authorities concerned have not accepted the company's figures. It appears that there is no alternative but to submit the whole case to arbitration. As the annual general meeting has to be held before the end of the year the directors have prepared a balance sheet, showing the position at December 31st, 1925, assuming that all the company's claims are admitted. This balance sheet shows that the company claims a balance of free reserves available for capitalisation amounting to £659,207. Under the sliding scale scheduled to the agreement under the Act, the company is entitled to retain a minimum of £350,000 out of its reserves "as at December 31st, 1924," and as by a decision of the Electricity Commissioners the sliding scale did not commence to operate until January 1st, 1926, the guaranteed minimum will be increased by the amount of profit which the company may be able to add thereto in respect of 1925. A resolution was therefore to be proposed at last Wednesday's meeting authorising the directors to effect the capitalisation from time to time of reserves available for that purpose by distributing fully-paid ordinary shares *pro rata* to the holders of the ordinary shares. A confirmatory meeting is to be held on January 12th. The standard amount authorised to be distributed in dividends upon the ordinary shares up to and including 1932 is £120,000, which represents a dividend at the rate of 18 per cent. upon the existing ordinary shares (*i.e.*, the rate of dividend which has been paid for the

years 1922 to 1925 inclusive), and this sum, if earned, will be distributed over such larger amount of ordinary shares as may result from the capitalisation of reserves. Such free reserves as the company may succeed in retaining beyond any amount agreed to be capitalised in the first instance, together with such additional profits above the standard as may accrue through the operation of the sliding scale, will be held for capitalisation at a future date. With regard to the generating arrangements proposals for the formation of a Joint Committee to direct the combined undertakings of the four companies of the group have been submitted to the Electricity Commissioners for approval. To provide for the repayment of loans the directors have created a 5-per-cent. consolidated debenture stock, and £220,000 of this has already been sold. Holders of the company's second debenture stock have been invited to exchange their holdings for the new stock.

Sir W. G. Armstrong, Whitworth & Co., Ltd. The Advisory Committee appointed to investigate the company's affairs has issued a report containing a scheme. This proposes that the net profits, after meeting the interest on the 4 per cent. first mortgage debenture stock, for the current and four subsequent years, shall be devoted to the payment of interest on the 6½ per cent. second mortgage debenture stock (up to 5½ per cent.), the 5½ per cent. notes, and the 6½ per cent. consolidated mortgage debenture stock. Any surplus will then be applied for the payment of the other 1 per cent. on the second mortgage stock, or arrears on the notes and the consolidated stock. It is provided that funding certificates shall be issued in respect of arrears of interest remaining at July 1st, 1931. The redemption dates of the second mortgage stock and the consolidated stock are postponed for 10 years. Power is given to the directors to mortgage the company's assets in priority to existing charges, and dividends on the share capital are postponed until all arrears of interest have been paid. Three-fourths of the directorate will be representative of the holders of the second mortgage stock, the notes, and the consolidated stock. If the scheme is passed and sanctioned by the Court, the company's bankers have agreed not to demand the repayment of their advances, up to an amount of £3,000,000, during the five years which the scheme covers, unless there is an available surplus after meeting interest. Meetings of stock and note holders have been called for December 22nd.

Venezuela Telephone and Electrical Appliances Co., Ltd. The annual meeting of the company was held on December 7th, Mr. J. S. Austen (chairman) presiding. In moving the adoption of the report, which was reviewed in our issue of December 3rd (p. 926), the chairman explained why the proposed sale of the company's property was not carried out. He said that after incurring a loss for some time on every new telephone installed the company decided to institute a new rate. Before this was actually done an offer to purchase the undertaking was received from Venezuelan interests, one condition being that the company should publish the new rate before the sale was completed. That was done, and the information that the company was to become a Venezuelan concern was well received. Then, however, the President of the Republic announced that he considered the proposed new rate excessive and that it ought to be 20 bolivars per month, less than the company was already charging. The President's action unnerved the buyers, and they declined to go on with the purchase of the undertaking. Moreover, the company had withdrawn, under advice, the notice regarding the new rate. The chairman said that, apart from that trouble, the position of the company had never been better, and they had had to consider further automatic equipment. The report and accounts were adopted.

British Columbia Electric Railway Co., Ltd. The report for the year ended June 30th last records total earnings of £573,234, and after providing for debenture interest and adding £60,890 brought forward, there remains £454,308. The dividend has been paid on the 5 per cent. cumulative stock, and interim dividends have been paid on the preferred and deferred ordinary stock at the rate of £4 7s. 6d., free of tax. It is now proposed to pay a final dividend at the rate of £1 17s. 6d. (free of tax) on the preferred ordinary stock, and one at the rate of £3 12s. 6d. (free of tax) on the deferred ordinary stock. The general reserve receives £40,000, and a similar amount is set aside for the establishment of an employés' pension fund; a balance of £67,794 is carried forward. Further progress is recorded: the number of passengers carried rose from 69,779,478 to 72,547,267, and the amount of energy sold from 322,656,645 to 356,277,447 kWh. The capital expenditure during the year amounted to over £700,000, and was mainly devoted to the further development of the new Alouette Lake power plant, rolling stock and extensions of the lighting, power and gas systems. The acquisition of the Bridge River Power Co. was reported last year; the growth of the demand in that company's area has encouraged the directors to proceed immediately with the first stage of the Bridge River development. The work includes the boring of a tunnel 2½ miles long, and it is hoped to have two 30,000-h.p. sets in operation by 1930. The development of motor-'bus traffic is being carefully watched, and the company has successfully established services between New Westminster and Vancouver and Chilliwack. It is proposed to establish an employés' pension fund. Unique success attended the sale of the company's securities to the public and its employés. To avoid the payment of British income tax upon dividends received by stock holders domiciled in British Columbia a subsidiary (Canadian) company has been formed, and securities have been transferred to this company—the British Columbia Electric Power & Gas Co., Ltd. The report records the death of Sir Ernest Harvey, K.B.E., and the appointment to the board of Mr. W. G. Murrin. The notice convening the annual meeting for yesterday (Thursday) stated that a resolution would be presented increasing the capital by the creation of an additional 320,000 shares of £1 each. An extraordinary meeting is to be held on January 6th to confirm this.

Foundation Co., Ltd. Sir Charles Davidson presided at the annual meeting on December 9th, in the absence of the chairman, Mr. A. W. Tait, C.B.E. He said that the year under review had been one of substantial progress in every direction. The new work booked during the year and since last June was of a satisfactory nature, and included further developments on the "Underground" system. The company was to construct large new power stations for the London Power Co., Ltd., and the North Metropolitan Electric Power Supply Co. Work of a similar nature had been carried out for the London Electric Supply Corporation and the Yorkshire Electric Power Co. Those contracts did not include the provision of machinery, but were confined to constructional work in respect of the buildings, foundations, and waterways. Reference was made last year to the company's participation in the operations of its sister companies in Europe, Africa, and Asia. That development was progressing satisfactorily, and large contracts were in progress in France, Belgium and Greece. The report and accounts were adopted.

Petters, Ltd. A letter has been sent to the shareholders stating that arrangements have been concluded to acquire, as from December 8th, the whole of the interest of Messrs. Vickers, Ltd., in Vickers-Petters, Ltd.

For a considerable time it has been felt that the joint ownership and control of the company was disadvantageous, and, as a result of negotiations, a favourable offer to acquire the sole ownership of the company has been accepted. The name of the company will be changed to Petters (Ipswich), Ltd., as soon as the necessary formalities are completed. The engines now produced by Vickers-Petters, Ltd., at Ipswich are a development of the larger sizes of the Petter oil engines, the manufacture of which was transferred from Yeovil in 1919. It is hoped that the economies which can be effected, and the advantage of unified control will justify the acquisition.

Brompton and Kensington Electricity Supply Co., Ltd. At an extraordinary meeting on Monday last, a resolution was adopted providing for the alteration of the articles of association. A further meeting is to be held on December 29th to consider resolutions providing for the raising of the capital to £400,000 by the creation of 100,000 ordinary £1 shares; the capitalisation of £58,466 of the reserves for distribution in the form of fully-paid bonus shares in the proportion of one new share for each five ordinary shares held; and the capitalisation of a further £23,520 of the reserves to be converted into fully-paid ordinary shares to be held for the benefit of a staff superannuation fund.

United Electric Tramways of Montevideo, Ltd.—A circular letter which has been sent to shareholders states that the company has acquired the other electric tramway company operating in Montevideo, known as La Transatlantica. The time appears opportune for distributing the interests of the company (which is a holding concern) over a wider range of undertakings. It has therefore been agreed to transfer the company's holdings to the Atlas Light & Power Co., Ltd. (until recently known as the Argentine Light & Power Co., Ltd.). Under this agreement the company will receive stock and shares of the Atlas Company. A meeting was to be held yesterday (Thursday) for the purpose of considering the matter.

New Issue.—*Fife Tramway, Light and Power Co., Ltd.*—Last week this company issued particulars, for information only, of an issue of £300,000 5½ per cent. 5-year registered notes (part of a total of £600,000 notes authorised). The notes are repayable at 102½ per cent. on December 31st, 1931, unless previously redeemed. On and after December 31st, 1927, holders can be repaid at par provided that they agree to subscribe for a similar amount of the company's 6 per cent. cumulative preference or ordinary shares, and the authorised capital will be increased as and when necessary to deal with this. The notes have been acquired or subscribed for, at 97 per cent., by the Power Securities Corporation, Ltd.

Bullers, Ltd.—The profit for the past year after providing for debenture interest, depreciation, &c., amounts to £3,557. It is proposed to transfer £5,000 from the general reserve, and this, with the amount brought forward, will make £14,223 available. The directors recommend that the preference dividend should be paid, that £5,808 should be transferred to the debenture sinking fund, and that £915 should be carried forward. The directors express the hope that the termination of the coal dispute will bring about an improvement in trading conditions.

Burndept Wireless, Ltd.—It is announced that the board has been reconstituted as follows:—Mr. J. McGregor (managing director of Johnson & Phillips, Ltd.), chairman; Mr. T. A. Barson, vice-chairman (co-opted at the request of the Shareholders' Committee); Mr. W. W. Burnham, managing director; Mr. C. F. Phillips, M.I.E.E., chief engineer; Mr. J. G. Scott (co-opted at the request of the Shareholders' Committee); Mr. C. Stewart, M.I.E.E. (director of Johnson and Phillips, Ltd.); and Mr. G. L. Wates.

Marconi's Wireless Telegraph Co., Ltd.—The directors have agreed to submit the report of Sir Gilbert Garnsey upon the company's affairs to a sub-committee of the Shareholders' Committee when it is ready. The proposals will then be discussed for the purpose of submitting agreed recommendations to the forthcoming shareholders' meeting.

Reduction of Capital.—ELECTRIC HOLDINGS, LTD., AND REDUCED.—A petition has been presented to the High Court for the confirmation of the reduction of the capital of the company from £5,000,000 to £4,425,000, and for the confirmation of an alteration of the company's objects; it will be heard in London on December 21st.

Victoria Falls and Transvaal Power Co., Ltd.—The directors have declared a dividend of 3 per cent. on the preference shares for the half-year ending December 31st, together with an additional 3 per cent. in respect of participating rights for the year. An interim ordinary dividend of 3 per cent. has also been declared.

Companies Struck Off the Register.—The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Dalziel's Constant Voltage Patents, Ltd.
Keynsham Electric Light and Power Co., Ltd.
Wireless Appliances, Ltd.

Melbourne Electric Supply Co., Ltd.—The directors propose to pay a final dividend of 5 per cent. (actual) on the consolidated ordinary stock, making 10 per cent., free of British tax, for the year.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Cornwall Power Co., Ltd.—150,000 7 per cent. convertible preference shares of £1 each, partly paid and fully paid, Nos. 250,001 to 400,000.

Burma Electric Supply.—100,000 ordinary shares of £1 each, fully paid, Nos. 1 to 100,000; 120,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 120,000.

Ericsson Telephones.—300,030 ordinary shares of £1 each, fully paid, Nos. 1 to 100,010 and 299,981 to 500,000.

Lancashire Electric Light and Power.—250,000 new 7 per cent. cumulative participating preference shares of £1 each, issued at £1 4s. per share, partly paid and fully paid, Nos. 750,001 to 1,000,000.

W. T. Henley's Telegraph Works Co., Ltd.—An extraordinary meeting is to be held to-day (Friday) for the purpose of considering amendments to the memorandum of association bringing it up to date.

Pinchin, Johnson & Co., Ltd.—The directors have declared a dividend at the rate of 6¼ per cent. on the preference shares for the half-year ending December 31st.

Cable Manufacturing Amalgamation Rumours.—The activity in connection with certain cable manufacturing shares, which is referred to in the next column, continued on the Stock Exchange on Tuesday. The amalgamation rumours are reported to arise from a circular issued calling a meeting of a well-known company for Friday (to-day). Tuesday's advances included a further 3s. in the case of Callender's ordinary, 2s. for Henley's, 1s. for British Insulated, and 6d. in Enfields.

South Metropolitan Electric Light and Power Co., Ltd.—It is proposed to capitalise £350,000 of the reserves, and to distribute this amount to the ordinary shareholders by allotting seven new fully-paid ordinary shares for every five held.

South London Electric Supply Corporation, Ltd.—The directors propose to capitalise £234,000 of the reserves, and to distribute this amount to the ordinary shareholders by allotting nine new fully-paid ordinary shares for every ten held.

County of London Electric Supply Co., Ltd.—The directors propose to capitalise £1,773,334 of the reserves, and to distribute this amount to the ordinary shareholders by allotting four new fully-paid ordinary shares of £1 each for every three ordinary shares held.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange business at the present time is very much on a par with that which is generally associated with this particular season of the year. In other words, there is not a great deal doing in the principal markets, and the attention of the public is directed mainly to investments in wares more appropriate to Christmas than stocks and shares are, although the younger generation will sometimes admit a condescending willingness to accept Stock Exchange securities in lieu of more fleeting or more frivolous gifts. There is a good supply of money available for new issues, and, notwithstanding the close approach of the New Year, a few big borrowers are in the field with substantial amounts of capital for which they await subscription.

The tale of London electricity supply companies which have now declared their bonus intentions in regard to the distribution of reserves is nearly complete. The Metropolitan is giving one new share as a bonus for each two ordinary shares at present held, the issue to be made from the reserve fund. The City of London Company has issued a notification which caused a drop of 5s. 9d. in the price of the shares. The authorities decline to accept the company's figures, and the directors say that, at the moment, there seems to be no alternative but to submit the whole case to arbitration. The County, South London and South Metropolitan Companies' results have yet to be made public.

Prices show a tendency to drift to the common level of about 24s. to 25s., at which level, taking the 7 per cent. yield as a basis, the return on the money works out to a shade above 5¾ per cent. Over the period of the next five years, that is to say, until 1931, the dividends will be higher. To take Chelsea shares as an instance, the return on the money between now and 1931 is likely to come to about £7 2s. per cent. on the money, reverting, in 1931, to the rate already mentioned, 5¾ per cent. Stock Exchange people find that the public dislikes, as a rule, an investment which carries a certainty of diminution of income at a fixed date. For this reason it is probable that electricity supply ordinary shares, in the companies working within the London area, are likely to remain a somewhat dull and listless market, unless something should happen that will put a new complexion upon the outlook. The market will become, in short, a gilt-edged section amongst industrial shares, and members of the public who buy Industrials do so, generally, with the hope of increasing their capital as time goes on. It is for this reason that the market in the London shares is, for the time being, very quiet, with a tendency to slightly lower levels on balance.

Lancashire Electric new preference shares command a premium of 1s. 3d. The new shares of the Midland Counties company, ordinary and preference alike, stand at 3d. to 6d. premium. The recently-issued Adelaide shares are quoted at 1s. premium.

To-day (Monday) there occurred a dramatic jump in Callenders and Henleys. The latter rose 6s. 3d. with a bound; Callenders gained 2s. 6d., at 86s. 3d. and 67s. 6d., respectively. No plausible explanation being immediately apparent, rumour seized upon the likelihood of possible amalgamation. The word is one to conjure with, in view of the tendency of modern industrialism, and anticipation became keyed up to a high pitch of expectancy for the reason of the buying that lifted prices so swiftly. British Insulated gained a few pence, India Rubbers came into mild demand. Johnson and Phillips at 58s. 9d. are 2s. 6d. higher. The market took on an aspect of decided strength.

Ever Ready ordinary are better at 76s. 3d.; the preference remain at 27s. 6d.

The Atlas Light & Power Company is about to take over the United Electric Tramways Company of Montevideo, which, in its turn, has agreed to acquire La Transatlantica, the other electric tramway of Montevideo. Debenture stock, preference and ordinary shares in the Atlas Light & Power Company will be given in exchange, and the announcement has been received with lively interest. Victoria Falls and Transvaal Power ordinary are steady at 53s. 9d., the preference at 32s. 6d., on declarations of an interim dividend of 3 per cent. on the former, and a distribution of 6 per cent. on the latter. The preference dividend includes 3 per cent. in respect of the shares' participating rights for the year 1926.

Automatic Telephones have gone back ¼ to 2 11/16ths upon sales by holders who assumed, rather hastily, that the shares will be affected by the new issue of International Telephone deferred, into which the Automatic holders are changing their Automatic shares; the price of the deferred shares in question has risen to 40s. 6d. This is a gain of 5s. 6d. since the deferred were introduced to the market about a fortnight ago. The Eastern group is very quiet. Vigorous efforts are being made to popularise still further the companies' facilities for the cabling at a cheap rate of Christmas greetings. Marconis remain at 16s. 3d. The company's position is being investigated by Sir Gilbert Garnsey, whose report and recommendations will be handed to the Shareholders' Committee. A meeting of proprietors will be called subsequently. Canadian Marconis show a little more life, on the understanding that the new Australian station may be opened before Christmas. This, it is hoped, will result in accession of business to the Canadian Marconi Company.

Anglo-Argentine Tramways continue to be a sensitive market and, after a fall in the first and second preferences, the prices rallied to their previous figures. Brazilian Tractions fell back. The common and preferred both stand on the same line of 107. British Columbia Electric Railway stocks are somewhat easier.

In the Home Railway section, Undergrounds are a good market, rises being credited to Metropolitans, Districts and Underground £1 shares. Dividend hopes furnish the inspiration for the cheerfulness in the stocks of the older companies. British Electric Traction put on 2 points, at 144½. A gain of 6d. lifted London and Suburban preference to 6s. 6d.

Iron and steel shares are adversely affected by a proposed moratorium of Armstrong, Whitworth stocks other than the company's first debenture. The second debenture has to-day fallen 9¾ points, the consolidated debenture 26, and the ordinary shares, at 3s., compare with 5s. 2d. at the end of last week. The figures published, in support of the moratorium proposal disclose a loss over the past few years, that can only be described as calamitous. Nevertheless, there are good reasons for assuming that the company can be tided over its troubles by the exercise of skilful management and patience. The rubber share market is uninteresting, with public interest tepid and public business torpid.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1924.	1925.	Price Dec. 13 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	60/6	—	4 12 7
Brompton Ordinary	1	10	10	1⅛	—	6 13 4
Charing Cross Ordinary	1	15	15	2⁷/-xr	—	5 12 0
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	45 9	—⁷/-	... ...
do. do. 6% Pref. ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	8⅞	+⅛	4 14 1
do. do. 6% Pref. ...	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	80 6	—	6 11 2
Kensington Ordinary	1	15	15	94/-	—6d.	5 16 8
Lancs. Light and Power	1	7½	7½	24/6	—	6 2 5
London Electric	1	10	10	85/-	—1/-	5 14 3
do. do. 6% Pref.	5	6	6	6⅜	—	5 11 7
Metropolitan	1	11	11	99/6	—1/3	5 11 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary ...	1	7	7	21/3	—	6 11 9
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—6d.	5 9 1
St. James' and Pall Mall	5	17½	17½	24/-	—6d.	5 16 8
South London	1	15	15	2⅜	—	5 14 3
South Metropolitan Pref.	1	7	7	1⅜	—	5 12 0
Urban Ordinary	1	4	7	1⅞	—⅛	5 17 11
do. 6 % Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	25/-	—6d.	5 12 0
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

Home Rails.

Central London Ord. Assented ...	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	64½	+2	7 17 6
do. District	,,	3½	3½	26½	+1	6 4 0
Underground Electric	£1	Nil	Nil	12/6	+6d.	Nil
do. do. Income ...	Bonds	6	6	102	—	*5 17 6

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	1	3	10	21½	—½	3 14 4
Chili Telephone	5	5	6	6¾	—	4 7 4
Cuba Sub. Ord.	10	5	5	7½	—	7 0 4
Eastern Extension	10	10	10	18	—	*5 11 4
Eastern Tel. Ord.	Stock	10	10	180½	—	*5 10 10
Globe Tel. and T. Ord.	10	10	10	18½xd	—	*5 8 1
do. do. Pref.	10	6	6	11xd	—	5 9 1
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	9½	10	47½	—	*5 5 10
Marconi	1	10	Nil	½	—	... ...
Marconi-Marine	1	10	7½	1½	—	6 13 4
Oriental Telephone Ord.	1	12	12	2⅞	—	*4 18 4
United R. Plate Tel.	5	8	8	7½	—	*5 2 5
Western Telegraph	10	10	10	17½xd	+½	*5 15 1

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	9½	—	9 15 6
do. do. 2nd Pref. ...	5	6	6	9½	—	10 8 8
do. do. 5% Deb. ...	Stock	5	5	65½	—	7 12 8
British Electric Traction Ord. ...	,,	7	8	144½	+2	5 10 9
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	107	—2	4 13 6
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	80½	—	5 15 7
do. do. Preferred ...	,,	90/-	100/9	117½	—1	*5 18 6
do. do. Deferred ...	,,	129/3	8	146½	—1	*5 9 8
do. do. Deb. ...	,,	4½	4½	77½	—	5 10 0
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/6	+6d.	Nil
London United Tram. Deb. ...	Stock	4	4	42½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0 0
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	70½	—	Nil
do. 1st Bonds	—	5	5	64½	—	7 15 0
Yorkshire (West Riding)	1	8	—	12/6	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	12	12	23/-	—	4 10 10
British Aluminium Ord.	1	8	10	44/-	+6d.	4 3 4
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	67/6	+6d.	4 9 0
Brush Ord.	1	10	10	26/6	—	7 12 4
Callenders	1	15	15	8⅜	+⅛	4 9 0
do. 6½% Pref. ...	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	12/9	—	3 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 8
Electric Construction	1	10	10	81/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	5	Nil	15/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	21/6	—6d.	5 15 7
do. Ord.	1	6	7½	30/6	—1/-	4 18 4
Henley	1	16	20	47½xd	+⅛	4 12 10
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	14xd	—	*4 9 0
Johnson & Phillips	1	10	17½	56 9	+2/6	5 19 1
Met.-Vickers Ord.	1	8	8	23/9	—	6 14 3
do. Pref.	2	8	8	2½	—	6 18 4
Siemens Ord.	1	7½	7½	2⁶/5	—	5 4 4
Telegraph Construction	12	20	10	25½	—	*4 1 4

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Dec. 14th.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4¼d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3¼d. to 3½d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£271	£7 dec.
Grade II ... ... ,, ,,	£189	£5 dec.
Grade III... ... ... ,, ,,	£1 0	£1 dec.
c Brass (rolled metal 2' to 12' basis) per lb.	9½d.	½ dec.
c ,, Tubes (solid drawn) ... ,,	1/0 to 1/0½d.	...
c ,, Wire, basis ... ... ,,	10½d.	...
c Copper Tubes (solid drawn) ... ,,	1/1	...
c ,, Bars (best selected) ... per ton.	£94	...
c ,, Sheet ... ... ,,	£92	...
c ,, Rod ... ... ,,	£92	...
d ,, (Electrolytic) Bars ... ,,	£65 5s.	...
d ,, ,, Sheets ... ,,	£14 : 10s.	...
d ,, ,, Wire Rods ,,	£75 5s.	...
d ,, ,, H.C. Wire per lb.	9½d.	½d. dec.
f Ebonite Rod ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
b Gutta-percha, fine ... ... ,,	8/-	...
b India-rubber, Para fine ... ... ,,	1.4½	1½ dec.
i Iron Pig (Cleveland No. 3.) ... per ton.	122/6	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£30 15s.	5/- inc.
g Mercury ... ... per bot.	£17 10s.	...
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2½	...
p ,, ,, wire... ... ... ,,	1/4	...
o Platinum ... ... per oz.	£3	...
d Silicium Bronze Wire ... ... per lb.	10½d.	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton.	£306 5s. to £30. 15s.	£8 15s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Boling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The British Association.—The Council of the British Association for the Advancement of Science has announced the names of the officers for the 1927 meeting, which is to be held at Leeds. The President is Sir Arthur Keith, F.R.S., the noted anthropologist. The sectional presidents include Prof. E. T. Whittaker, F.R.S. (A.—Mathematics and Physics); Dr. N. V. Sidgwick, F.R.S. (B.—Chemistry); Prof. D. H. McGregor (F.—Economics); and Prof. Sir J. B. Henderson, D.Sc., M.I E.E. (G.—Engineering). Sir James Henderson is Professor of Applied Mechanics at the Royal Naval College, Greenwich. He was formerly head of the scientific department of Messrs. Barr & Stroud, Ltd.

Wireless Control of Aircraft.—On the occasion of the bestowal of the highest award in the United States engineering profession, the John Fritz gold medal, upon Mr. Elmer Ambrose Sperry on December 7th, Mr. William Saunders, chairman of the Naval Consulting Board, described Mr. Sperry's experiments with so-called aerial torpedoes. According to *The Times*, he said that shortly before the Armistice Mr. Sperry had proceeded so far in the design of a wireless control for aeroplanes that he was able to direct an aeroplane automatically against a target 35 miles distant. It was, he said, possible to increase the distance threefold. With a large charge of T.N.T. and sensitive contact fuses, these "air torpedoes" were catapulted into the air at flying speed, rose to a predetermined height, then automatically assumed a flight path and were automatically guided with great precision and, after traversing the predetermined distance to a fraction of a mile, suddenly descended vertically with enough explosive to destroy a fortress, munition dump, or small town.

Kiosk-Type Sub-Stations.

Recent Developments.

THE kiosk-type sub-station is becoming increasingly popular in connection with electricity supplies to isolated areas, and two such stations which have been recently supplied to the Burnley Corporation Electricity Department have attracted considerable interest. They were supplied by Messrs. Long and Crawford, Ltd., who have made an effort to remove the stigma of "hen-house" appearance to which this type of sub-station has been subjected by some engineers. These kiosks

Fig. 1.—Burnley Kiosk, h.p. Side.

are built on a substantial angle- and tee-iron framework surrounded by heavy sheet-steel plates. The structure is covered by a welded-steel roof with a beading fixed at the lower extremity of the turned-down edge. A gap all round the underside of the eaves provides ample ventilation, and is suitably baffled to prevent the ingress of rain or snow. The root or under framing, which is concreted in the ground, is detachable, enabling it to be grouted in on the site so that the concrete can be allowed to set before the body of the

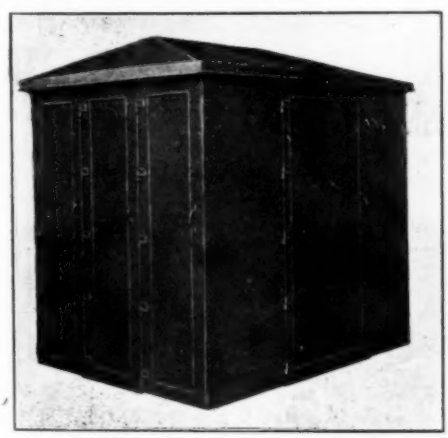


Fig. 2.—Exterior of Long & Crawford "Sub."

kiosk is bolted on. The interior is divided into three main compartments for the e.h.p. and l.p. switchgear, and the power transformer respectively. The e.h.p. portion is again sub-divided into smaller compartments, as shown in fig. 1. The three lower sub-compartments contain the isolating links and bus-bars for the ring-main connection, and also the terminal boxes. The other sub-compartments contain the isolating links, oil switch and current transformers respectively. The transformer chamber, which is large enough to accommodate 200 kVA of apparatus, is in the centre of the building with a door at each side. The floor of this chamber consists of thick sheet-steel strengthened with girders and provided with guide rails for the transformer rollers, these being adjustable for variable sizes. The l.p. switchgear consists of slate panels carrying a triple-pole knife switch and an ammeter on each phase. Four outgoing circuits are provided for, each being controlled by a fuse in each phase and a link on the neutral wire. Each of the three main compartments is lighted by a lamp supplied from the l.p. side of the transformer, through a switch and fuses, and the connections between the compartments are made with bare copper passing through porcelain bushes. Ample space is allowed in each compartment for the apparatus to be accommodated. Fig. 2 shows the exterior of the kiosk.

Fig. 3 shows the h.p. side of a kiosk transformer sub-station of a range which has been developed by the General Electric Co., Ltd. It is constructed of heavy-gauge steel-plate with a welded-steel roof. Cast-iron mouldings and cornice pieces are provided, while the design of the sub-station ensures, it is claimed, the structure being absolutely weatherproof. The station is divided into three compartments, the step-down transformers being accommodated in the middle section, with the high- and low-pressure switchgear on either side. Steel-plate doors are provided for each section. The equipment of the h.p. side consists of an oil circuit breaker with overload and leakage trip coils, and current transformers for use with the latter; the circuit breaker is isolated from the supply by means of isolating links.

The h.p. switchgear and connections are enclosed by double doors, and the inner doors, enclosing the isolating links, are fitted with padlocks to prevent tampering by unauthorised persons.

On the l.p. side are installed G.E.C. unit-type "Hand-guard" fuses mounted on bakelite tubes, while ammeters and voltmeters can be supplied if required. Cable boxes with efficient sealing devices are also provided for use with all cables.

The l.p. switchgear is mounted on bakelised metal tubes, not on slate slabs; the former provide, it is claimed, more efficient insulation, and are a much better proposition for this class of apparatus. The equipment is mounted well inside the kiosk, and it is not possible for rain to drip on any portion of the apparatus when the doors are opened. At the same time both the switchgear and the transformer are readily accessible for adjustment or other purposes. The sub-station is well ventilated and vermin-proof, and is suitable for installation on a ring-main system.

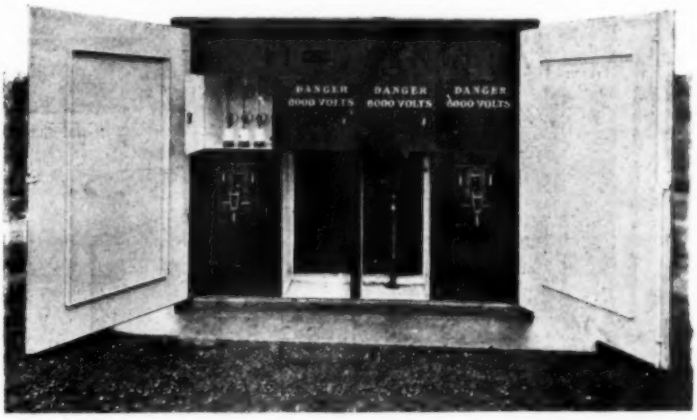


Fig. 3.—G.E.C. Kiosk, h.p. Side.

A Large Electric Winder.—An electric winder of 1,130 h.p., r.m.s. rating, capable of exerting a maximum peak of 2,800 h.p., has been ordered from the Metropolitan-Vickers Electrical Company by Messrs. James and Alex. Brown, of Richmond Main Collieries, New South Wales. It is to be installed at a new shaft at Stockrington Pit, near Newcastle, and is to lift a net load of six tons from a depth of 920 ft., with an output of 400 tons per hour. The set will be controlled by the Ward-Leonard system, and the main motor, operating at 39.7 r.p.m., will be directly-coupled to a 13-ft. cylindrical drum. Power for the main motor will be supplied by a motor-generator set consisting of an induction motor of 620 h.p., 1,000 r.p.m., driving a 790-kW, d.c. generator, with a 6½-ton flywheel. A Lily overwind and over-speed protection device will be fitted to the winder. The drum and other mechanical parts are to be supplied by Messrs. Vickers, Ltd., whose new system of oil braking will be used. This is the second large Metro-Vick electric winder recently ordered for New South Wales, the other equipment being for the Caledonian Collieries, Ltd., the workings of which adjoin those of the Richmond Main Collieries.

Electrical Gifts for Christmas.—IV.

Among the many fires made by the Credenda Conduits Co., Ltd., is that shown in fig. 32. A feature of this is the flat top, backed by a polished copper reflector, upon which a hinged trivet rests. The upward heat is sufficient to keep a kettle or saucepan simmering when placed on the trivet as shown. Two 1-kW fire-bars are fitted; these are separately controlled. Another "Creda" appliance is the afternoon tea kettle (fig 36). A novel shape and an excellent nickel-plate finish are the features of this appliance. The capacity is 2½ pints and the loading 500 W.

Many "Tricity" appliances are available from the establishment of the British Electric Transformer Co., Ltd. One of these is the reversible toaster depicted in fig. 41. This has a frame of copper mounted upon a cast-iron base and is finished in nickel-plate. By lowering and raising the gates, which are fitted on both sides, the bread is automatically reversed. The appliance has a loading of 450 W. Another "Tricity" appliance is the kettle shown in fig. 38, which is typical of a series ranging from 1¼ to 3¼ pints capacity. These are of polished copper, with loadings rising from 400 to 750 W, but they can be nickel-plated if preferred.

The "Heatrae Luxor" fire (fig. 33) is one of the patterns made by Electric Fires, Ltd. It has a hammered copper reflector, which is polished and lacquered and the fire-bar (1-kW) is fitted at the base of the reflector. A wooden handle is fitted to provide portability, and the fire is available in three finishes—polished brass, polished copper, or oxydised copper.

A large range of appropriate articles is available from the Dowsing Radiant Heat Co., Ltd. Among these is the home curling-tong heater (fig. 40), which is fitted with an automatic switch which cuts off the current when the tongs are removed. Another "Dowsing" device is the bed-foot warmer (fig. 44), which is of the heat-storage type. After being connected to the mains for 10 or 15 minutes, it will give out heat for four or five hours. Fig. 42 depicts the company's tumbler heater. This consists of a nickel-plated spun tumbler which fits into a heated receptacle. It has a regulating device which enables the current to be cut down, when the liquid in the tumbler is heated, from 100 to 6 W. Its capacity is ½ pint.

Messrs. A. H. HUNT, LTD., are agents for the "Hellesen" battery, and in connection with this produce a large range of torches and other small electric lamps. Three examples are illustrated in fig. 39. The two portable lamps are, respectively, the senior and junior "Sunlite" models, and both are finished in nickel plate or oxydised copper or silver. The other appliance is a "Moonbeam" focusing torch, which is capable of projecting a 300-ft. concentrated beam. It can be clipped to a gun or rifle for night shooting.

As usual, Messrs. Ward & Goldstone, Ltd., have a large selection of suitable articles for presentation at Christmas. One of these is the "Cozytowz" electric foot-warmer for use in cars. This is designed to run off the lighting accumulators, and is made for 6, 8 or 12 V. Another useful device is the portable bell set illustrated in fig. 43. It comprises a

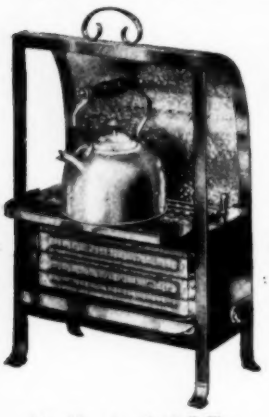


Fig. 32.—A "Creda" Fire.

Fig. 33.—The "Heatrae Luxor" Fire.

Fig. 34.—Alarm Clock Stand.

Fig. 35.—The "Spersom" Lamp.

Fig. 36.—An Afternoon Tea Kettle.

Fig. 37.—A Battery-Lamp Standard.

Fig. 38.—A "Tricity" Kettle.

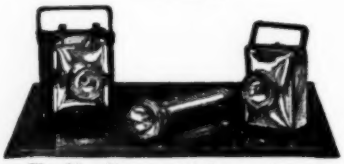


Fig. 39.—Three useful Battery Lamps.

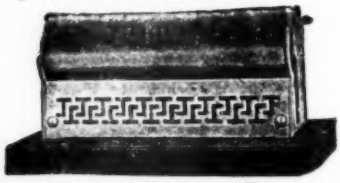


Fig. 40.—A Curling-tong Heater.

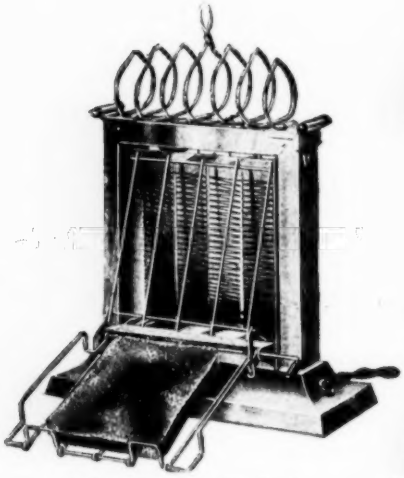


Fig. 41.—A Reversible Toaster.

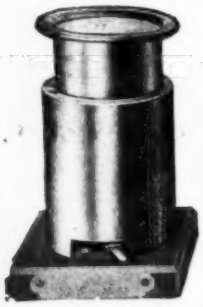


Fig. 42.—A Tumbler Heater.

Fig. 43.—A Portable Bell Set.

Fig. 44.—A Bed-Foot Warmer.

polished wooden case containing a dry battery, a loud-ringing bell, and a long flexible cord fitted with a pear push.

Messrs. Falk, Stadelmann & Co., Ltd., have a large range of domestic appliances and battery-lighting equipment. Among the latter are an alarm-clock stand (fig. 34) and a table standard (fig. 37). The clock stand has an enamelled metal case and a socket and switch mounted at the foot of the clock. The table standard consists of a neat shade and stem, mounted on a black enamelled metal base.

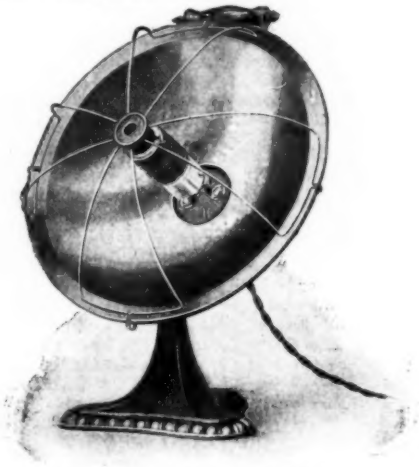


Fig. 45.—The "Angelus Firefly" Bowl.

The "Spersom" adjustable lamp (fig. 35) is a very convenient type of fitting supplied by Messrs. Charles Joyner and Co. This is nicely balanced, and has a heavy cast brass base, which enables it to be used as a standard. In the base is a strong spiral spring, by means of which the lamp can be clipped to any piece of furniture. The lamp is mounted in a switch-holder. Fig. 45 shows the "Angelus Firefly" bowl-fire made by the same firm. It consists of a solid spun copper bowl mounted on a bronze-finished cast-iron base. The coiled element has a rating of 600 W.

In addition to its washing machines, ironers, fires, and other domestic devices, the Hotpoint Electric Appliance Co., Ltd., is supplying a number of toy cookers and engines; we illustrate an example of each class. Fig. 46 shows a very complete model range with a full set of utensils. The loading is 600 W, and the dimensions are 15¼ in. high, 15 in. wide, and 6¼ in. deep. The engines include the vertical model shown in fig. 47. This is equipped with a water-gauge glass, a flywheel and all the usual "gadgets," and should prove as acceptable to a boy as the range will to a girl.

Fig. 46.—A Toy Cooker.

Fig. 47.—A Toy Electric "Steam" Engine.

Fig. 48.—The "Lounge" Fire.

Fig. 48 illustrates one of the imitation coal fires made by Electric Heating and Hardware, Ltd. It is the "Lounge" model, and, as will be seen, is ornamental as well as useful. It has a cast back panel, and contains "coal" and "logs" of realistic appearance. The loading is 2,250 or 3,000 W, and four finishes are available, *viz.*, antique brass, oxydised copper, armour bright and oxydised silver.

Lecture.—By arrangement with the Board of Trinity College, Dublin, Dr. Alfred Ekström lectured last week to a large audience in the Members' Hall of the Royal Dublin Society, on "The Application of Electricity to Domestic Purposes." He illustrated his lecture by a series of kinematograph pictures.

Applications of Electricity.

A General Survey of some of the Important Features.

By G. H. NELSON, M.I.E.E.

(*Abstract of Chairman's Address before the* SHEFFIELD SUB-CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

IN the States of Indiana, Illinois, Ohio, Michigan, and Wisconsin, an area of about 248,000 sq. miles, with a population of 22 millions, the annual consumption of electricity per head is 800 units, four times that per head in Great Britain. This difference is not due to greater hydro-electric facilities. Every thinking man, having these figures before him, must realise the wonderful possibilities of development of electricity supply as a result of the Electricity Bill in our little island with its dense population.

Obviously the duties of some, perhaps many, officials connected with generation and distribution will be changed, but the officials so affected should not assume that those changes will be to an efficient man's detriment; on the contrary, if the consumption of electricity per head of population increases in similar proportion to that of the States mentioned previously, every efficient engineer at present in the industry must have greater scope, whether he be at present a manager or a junior official.

Power will be available outside the present congested suburban areas. This will enable industrialists to establish their factories away from the large centres, giving the workpeople better living conditions. This no doubt will contribute to the removal of one of the causes of industrial unrest. During my visit to America four years ago I was struck with the progress made in these directions, and particularly the tendency for companies owning huge works to decentralise into smaller separate units, and establish them in districts away from big towns.

If we electrical engineers fully consider these wide and broad possibilities, and enthusiastically push them, we can take satisfaction that, in addition to the advancement of our profession, we are endeavouring to add to the comforts, and perhaps the pleasures, of many of our fellow-men.

The availability of power supply on the grid must increase the possibilities of electrification of railways in Great Britain. The Ministry of Transport estimates that if all our railways were electrified they would take 4,600 million units per annum, equal to the present number sold in Great Britain. The outstanding feature that strikes anybody associated with this particular side of the industry is that development is going on much more rapidly outside Great Britain than within it; at the special works of one of our great electrical firms, devoted to the manufacture of traction motors, which has been working at its full output during the last two years, 80 per cent. of the total work carried out has gone to equip the electrified railways of Australia, South Africa, the Continent, Argentina, Brazil, Japan, India, &c. This speaks very well for the progressive spirit in these lands, but is also a reflection on this country, where we have a population of nearly 50 millions, with greater concentrations of people and railway traffic than most of the countries referred to. There is no doubt that the residential quarters surrounding our great cities and industrial areas generally could be much better served by electrified lines, and this work in some cases has been delayed on account of the capital cost involved in power supply.

In the North-East States of America no less than 2,200 million units of electricity is used per year for electric railway purposes, as against 386 million units in this country.

Those in contact with railway employés should impress on them that they have nothing to fear from the introduction of electrified lines. With the present design of electrical apparatus, there is no reason why the existing mechanical staff should not take over the bulk of the electrical duties. The apparatus is easy to understand. After a few simple lectures and demonstrations by competent men one can learn quickly what is necessary in the operation or driving of trains. Experts are, of course, necessary for instruction and supervisory purposes, but most of the other duties connected with

the operation and maintenance of electrical equipment can be undertaken by the existing staff.

D.c. motors have the most suitable characteristics for driving an electric train, because of their better starting torque, acceleration and speed control. The present international standard voltages for d.c. motors are 600, 750, 1,500 and 3,000 volts. These higher d.c. voltages have introduced new problems, which we have been eminently successful in solving in this country, so much so that under the severest conditions of railway service the percentage of breakdowns is extraordinarily low, and I should say that we are probably turning out the best apparatus in the world.

To meet the service conditions of new electrified lines two main problems have had to be met, namely, the accommodation of higher-powered motors than had been built before and the adoption of the higher voltages to secure the most economical transmission and running conditions. For instance, in pre-war days a 300-h.p., 500-volt motor with a speed of 1,800 ft. per minute had a 6-in. gear face with a tooth pressure of 900 lb. per inch of face. A 300-h.p., 1,500-volt motor to-day, with a speed of 1,400 ft. per minute, has a 4½-in. gear face, with a tooth pressure of 1,500 lb. per inch of face. These increased tooth pressures have been made possible by the use of alloy steels, and most accurate machining of both motors and gears to ensure the best alignment of the wheels and pinions. Owing to the fixed space available for the accommodation of motors, determined by the gauge, the designers have had to overcome many difficulties. Some accommodation for the extra material and air-creeping surfaces demanded by the higher voltages has been obtained by close attention to the design and manufacture of gears.

The adoption of forced ventilation for traction motors is another innovation. It is now quite a usual thing for 2,000 cubic feet of air per minute to be passed through each motor.

With regard to developments in connection with tramways, the outstanding advance has been the speeding-up of the tramcar so as to increase the average speed of a journey, and the substitution of a motor of higher speed which gives a lighter weight for the same horse-power. The pre-war 50-h.p. motor on the one-hour rating weighed approximately 2,700 lb. complete with gear wheel, whereas the present-day motor of the same horse-power weighs 1,700 lb. This has been made possible by the use of alloy steels, hardened gears, and a ventilated motor, which has meant improvements in insulation and impregnating materials and processes, and accurate workmanship.

There is no doubt that in congested districts where large bodies of people have to be handled in a short time, the electric street car is the cheapest and best method of transportation.

One of the matters to which I am giving continual thought is that of industrial efficiency. This question cannot be ventilated too often.

We should never criticise destructively, always constructively. We should study our organisation and see that, as far as we are each individually able, no delays occur, remembering that time lost can never be made up. Let us fully realise that the essence of efficiency in industry is co-operation between all branches of that industry, be it finance, design, manufacture, or distribution. No advance can be made by destructive criticism, whether from one section or the other.

Railway Signalling and Communication.

The Characteristics and Applications of Electric Power from Various Sources.

By M. G. TWEEDIE, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF RAILWAY SIGNAL ENGINEERS.)

IN his presidential address in 1925 Mr. A. F. Bound said:—"A direction in which our Institution might do some valuable work should be to investigate and report on the subject of the cheapest and best means of producing electrical energy for all the various functions employed, from an electrical interlocking frame down to a simple high resistance indicator, and included should be a reference to any available means for reducing the current consumption."

Up to the present it has not been possible to do any work in this direction, and there is very little information on the application of electricity for railway signalling and communication.

Putting "all the eggs in one basket" has to be carefully balanced against the great economy which generally can be obtained by using a common source of power, whether it be a bank of primary cells or a local authority. The reliability of supply is generally of first importance, and there are a number of causes of failure when primary and secondary cells are used; also a satisfactory method of easily and accurately ascertaining the state of discharge of all types of cells has not yet been discovered, for it is quite impossible (on account of expense alone) to provide all circuits with integrating meters to measure output with precision.

When considering the annual cost of a source of power, cheapness must be viewed from the broadest standpoint. Why cannot electricity at 3d. per kWh be used for feeding, for instance, the repeater circuits from a distant signal, or to operate distant-signal machines? There is no technical reason, but the first cost of the plant to do it would be excessive, seeing that arm and lamp repeater circuits only require 0.4 kWh per year. The other extreme is the large all-electric signalling installation with a constant detection current of some amperes flowing, with frequent rushes for a few seconds of 3 to 5 amperes, or the common-battery telephone exchange requiring 10 amperes or more when it is busy. These are the cases wherein cheap power can be used with advantage.

A table (in the original paper) gives the approximate cost of obtaining 1,000 watt-hours from various sources, including primary cells and portable accumulators; it shows that when a plentiful and steady supply up to about 7 kWh per week is required, the portable accumulator is the least expensive; power generated by small isolated plant is usually the most economical arrangement for loads of more than 7 kWh per week when a supply from a local authority is not available. Due to cheapness in first cost, owing to their simplicity and the absence of any necessity for special accommodation or apparatus resulting in low installation charges, the use of dry and wet primary cells has been resorted to in many instances. When power is required in any amount, say, more than 50 watts, it is cheaper to install a battery of 120 Ah, 2 V, portable accumulators. When larger demands require 110 volts, a supply from a local company or the provision of some form of small power plant is to be preferred.

Variations in voltage may have serious effects on signalling and other circuits. A voltage curve which slopes, having a 33-50 per cent. difference between the commencing and final values, makes the source of power from which it emanates unsuitable for some purposes. The voltage of supply services from local authorities being usually steady, makes such a source of power very suitable if it can be applied direct; this can be done when a.c. is available, circuits being fed through transformers and, if desired, small static rectifiers.

As regards ease of maintenance, it remains still difficult to find men willing and able to look after complicated plant. The extra skill required justifies higher remuneration, which factor has to be borne in mind when designing installations. Plant requiring the services of the manufacturer's staff when certain parts of it go wrong, is not suitable for railway signalling purposes.

Sources of Supply.—The earliest source of electricity for railway signalling and communication was the primary cell; a number of excellent types are available. Regarding the proportioning of the constituents, cannot such cells be designed so that all the elements are consumed together and so save waste of some of them due to the exhaustion of the other part of the cell? The difficulty and labour involved in replenishing wet primary cells add greatly to the cost of the electricity produced, and during the last twelve years the use of the portable lead-acid accumulator has been greatly extended; recharging is easy and cheap, but a well organised system of distribution is required (such a system is described in the paper).

When no local supply is available, recourse must be had to independent power plant deriving energy from coal, petrol, oil, or wind. A source of power when batteries are objected to is the small hand-driven generator. For circuits requiring low-frequency a.c., *viz.*, 12-18 cycles, such as magneto telephone bells or indicators, &c., a hand-turned magneto is popular for small telephone installations. For the operation of electrically-operated point motors, signals, &c., a small d.c. dynamo revolved by a handle through gearing is finding application in a number of installations; they give about 120 watts at 100 volts and points are moved over by a few turns of the handle. When used on a circuit where a "hold-off" current is required, a primary battery is brought into use by a relay when the dynamo ceases to generate.

Circuits for Signalling and Communication.—The circuits employed are extremely varied, requiring from a few milliamperes at 1 to 3 volts d.c. once or twice a day to steady demands of many amperes a.c. at 110 volts or higher.

A table (in the original paper) contains data for a few representative pieces of apparatus. In the past it has been the object of instrument and apparatus designers to reduce the watts necessary for operating signalling apparatus to the minimum, with a view to economising battery power. The exquisite workmanship and ingenuity shown in design re-

sulted in a microscopic power consumption, and instruments became so sensitive that a limit to minimum operating current has had to be introduced into specifications, to prevent such apparatus responding to earth currents due to magnetic storms, leakages from power systems, electric railways, &c. Careful circuit design has economised power, by the use of relays to switch on power locally and thus save transmission losses.

Choice of Power Source.—For circuits the interruption of which results in serious consequences, first-class primary or secondary cells are the best; a well maintained accumulator battery is very reliable and suitable for many important purposes. The supply given by local authorities from their power stations is in most cases of a high standard of reliability. For constant- or fluctuating-current circuits of 24 volts or over, taking more than 0.25 ampere or 42 Ah per week, a small plant taking power from a public supply at 3d. or less per kWh may be considered.

For generating power at installations away from a public supply, the use of modern petrol-electric sets will be satisfactory and economical. At exposed situations it is an open question whether windmill plant would not be the cheapest to run; it has strong claims for consideration. During unusually long periods of calm, a portable petrol-electric set could be brought from headquarters without much trouble to recharge the battery, such a set being able to look after a large number of windmills and could be used in other ways.

Many important economies in railway signalling and communication plant, both in first cost and annual maintenance, have been, and can be, realised by careful combination of electricity supply questions, and it is a field worthy of much attention.

The Rugby Radio-Telegraph Station.

Some Design Details of the High-Power Transmitter.

By R. V. HANSFORD, D.Sc., M.I.E.E., and H. FAULKNER, B.Sc., A.M.I.E.E.

(*Abstract of Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper deals with certain specific details of design and operation of the high-power valve transmitter installed at the Rugby radio station. Part I discusses the arrangement of the coupled aerial circuit of a valve transmitter, and shows that certain circuits have considerable advantages over others in respect of the elimination of harmonics. Part II indicates the considerations which govern the choice of the electrical proportions of the intermediate and aerial circuits, simple formulæ being given for the calculation of the different quantities involved. Part III deals with the design of large inductance coils, and compares measured values of the high-frequency resistance of certain coils with the calculated values.

Part IV contains some notes on valve-circuit design, compares two conditions of operation of a valve transmitter and gives an analysis of the present operating condition at Rugby. The actual design of the electrical proportions of the anode and grid circuits of a high-power valve transmitter is a question of the application of experimental data obtained by suitable tests with one or more valves of the type it is proposed to use. The design consists in proportioning the electrical constants of the circuits so that the voltage swings previously proved to be satisfactory with one valve are reproduced in the high-power transmitter. Experiments which were carried out on a 30-kW installation at the Northolt radio station, using the valves proposed for use at Rugby, showed that there were two extreme conditions of operation which appeared to give almost identical results in so far as output and efficiency were concerned, the grid a.c. voltage and the negative grid bias being very much greater in one case than in the other.

The performance of a power-valve oscillator, or amplifier, as regards output and efficiency depends principally upon (*a*) the shape of the pulse of anode current; and (*b*) the corresponding variation of voltage on the anode. It is interesting to note that the author's experience indicates that with a high-power transmitter using a large number of valves it is preferable to work with an anode current pulse of a different shape to that generally accepted in this country as the best and most efficient for operating a telegraph valve transmitter. It is thought that the latter in general leads to slightly higher efficiencies when working at comparatively high anode voltages; probably for this reason it has been commonly used, as radiation-cooled valves (being limited in power output by the safe anode dissipation) demand the highest possible efficiency of operation. If, however, water-cooled valves are used the question of anode dissipation is not a limiting factor. The number of valves which it is necessary to use to produce a particular output is independent of the efficiency of operation within very wide limits, but is dependent upon the output which it is possible to obtain at a particular filament brilliancy. The authors' method demands considerably less maximum emission from the filament for the same output, which means that either fewer valves can be used or fewer renewals will be required. The advantage thus to be gained depends upon: (1) The cost of valve renewals; (2) the cost of power; and (3) the difference in efficiency as between the two methods of working. At Rugby a reduction of 6 per cent. in the efficiency of working can be allowed if the average life of the valves is increased thereby by 3.5 per cent., and the method of operation is believed to be thoroughly justified from the economic point of view.

A further advantage lies in the fact that the grid voltages are very considerably less under these conditions, which is a useful consideration when small stabilising condensers are connected between the grid and filament of each valve; this is also of great importance when working at very high frequencies. Another substantial advantage also arises in the case of high-power installations from the fact that greater outputs and higher efficiencies are obtainable by this method when working at lower anode voltages, the desirability of which arises from the experience that the behaviour of valves when tested in a low-power test set may be very different from that which obtains when used in a high-power transmitter.

The fundamental reason for this difference in behaviour would appear to be the existence of a phenomenon which is quite outside the usually accepted thermionic theory, but is known to some manufacturers and users of high-power valves. Current discharges, which are many times the maximum emission current of the filament, can and do take place through a valve, and may leave it quite unaltered as regards hardness and characteristics. Cases have occurred where such a discharge current through a single valve has operated the main high-speed circuit breaker (that is, the current was in excess of 400 A), and the valve has proved afterwards that it was still a good hard valve within the usually accepted meaning of the term, by passing all the usual acceptance tests for vacuum, &c.

The reason that this phenomenon becomes more pronounced and troublesome with high-power sets using a large number of valves in parallel appears to be largely one of voltage regulation. The discharge in a small-power set causes an immediate drop in voltage which allows the valve to regain its equilibrium, and the discharge may be thus self-healing and pass entirely unnoticed. In the case of a high-power set, the voltage-drop on overload is not so marked, and the valve has not the same opportunity of quick recovery; in these circumstances the discharge often causes the vacuum to be broken down and the valve may in some cases be destroyed.

The destructive effect is less if a rectifier unit is used rather than a d.c. generator as the source of the high-voltage d.c. supply on account of the poor voltage regulation and the current limitation of the former, but for a commercial telegraph service it is necessary to work with a voltage at which the effect is not likely to occur, so as to avoid interruptions. Under certain conditions the use of an economical thermionic current-limiting device might be associated with d.c. generators with advantage.

It is known that the same, or similar, discharges take place in other types of valves, although their vacuum is the best that modern methods can produce. Sparks have actually been observed inside glass and silica valves installed on small-power sets, without any apparent effect upon the operating conditions at the time. The phenomenon may occur with hard valves (which have previously been tested singly on a test set at 12,000, or even 15,000, volts) in the region of 7,000 volts (d.c.) and becomes more frequent and destructive as the voltage is increased. This leads to the conclusion that in the present state of valve development high-power sets should be designed to work on comparatively low voltages of the order of 7,000 V.

It has been shown that with the method of operation represented at Rugby good output at very reasonable efficiency is obtainable at comparatively low voltages, and there is no doubt that the figures could be much improved if the valves were specially designed for working thus. Power-valve development up to the present has proceeded mainly on the lines of increasing the permissible working voltage, and this is obviously the first line of attack in any attempt to produce a high-power valve, but the writers point out that this is not the only line of development. Until the phenomenon which has been described is thoroughly understood, there would appear to be room for a high-power transmitting valve designed for medium voltages and making up for reduction of permissible working voltage by having a greater filament emission, preferably at a low temperature.

In Part V of the paper are reproduced oscillograms of the shape of signals emitted when using different keying arrangements, which indicate the improvement obtained in certain cases; transients due to keying are discussed briefly also. Part VI gives the results of recent signal measurements and

a schedule of readings under present normal working conditions. Since Mr. E. H. Shaughnessy read his paper* the complete aerial, supported on 12 masts, has been brought into use for the telegraph set. The aerials on the north and south sides of the building are led in separately and are joined in parallel by means of a stranded-wire cable supported by insulators from the roof inside the building. The use of the combined aerial has enabled the normal working current to be increased from 550 to 740 amperes. At the time of writing it is thought that neither the VT26-type of valve rated at 10 kW output per valve, or the VT30-type rated at 20 kW, has reached its maximum output so far as conditions of operation at this station are concerned. It is certain, however, that neither type of valve, as at present manufactured, would operate satisfactorily in the large transmitter at Rugby under the voltage conditions at which each one is tested before acceptance for the reasons given previously. With masts earthed, an aerial current of 810 A has been obtained, using the 54 valves type VT26.

The present limiting condition with regard to aerial power output is the voltage on the aerial system, the normal working value of which is of the high order of 165,000 V. During the experimental stages the dielectric losses in the wooden frame of the glass window which supports the lead-in insulator caused the former to char and commence to burn. It was necessary, therefore, to erect an earthed guard ring around the window, which eliminated the charring completely, but reduced the distance from the lead-in conductor to earth. An occasional flash-over occurs under bad weather conditions if aerial currents in excess of 740 A are used. A longer insulator is being manufactured with the object of removing this limitation; meanwhile the provision of a canopy to protect the insulator from bad weather, together with an increase in the size of the aerial conductor near the lead-in insulator to 18 in. diameter, are giving very promising results.

Tests were recently carried out to ascertain the difference in signal strength as between masts insulated and masts earthed. The station was worked under these two conditions on alternate days for a few weeks and the signal strengths compared at various places all over the world. Whilst there was no very marked difference in aural reception, the general consensus of opinion of the reports was that the signal with masts insulated was slightly stronger than with masts earthed. The increase in signal strength at Houlton, Maine, due to the insulation of the masts, is of the order of 7 per cent., and at Washington it is about 9 per cent.

* ELECTRICAL REVIEW, April 30th, 1926; p. 716.

Russian Electrical Notes.

[By Our Special Correspondent.]

Production in 1926-27.—According to information placed before the General Electrical Commission, the value of the production of all kinds of electrical manufactures in 1925-26 amounted to 93,590,000 roubles, or 88 per cent. of the predetermined programme. As proposed for the current year (1926-27), the value of the output is to reach 119,725,000 roubles, but the absorbing capacity of the market is expected to be represented by a value of over 189,000,000 roubles, the construction of dynamos in particular being likely to fall very short of the demand owing to the deficient production of dynamo iron. The Industrial Planning Department of the Supreme Council of National Economy has confirmed this programme. The scheme contemplates a reduction of 16 per cent. in the prices of the heavy electrical products, 10 per cent. in those of the Low-Pressure Trust, and 12 per cent. in those of the Accumulator Trust. As a result of the adoption of a number of organising and technical measures, it has been possible for the State Electrical Trust to bring about an increase in the monthly output per workman at the three dynamo works and thus decrease the costs of production, so that it has now been possible for the Trust to reduce the sale prices of dynamos by from 12 to 15 per cent. and also expedite delivery. Economies are also claimed to have been effected in the manufacture of cables, lamps, and insulators.

Capital Expenditure.—It is stated that the capital expenditure incurred in developing the manufacturing industry in 1925-26 amounted to 12,495,000 roubles, of which 10,267,000 roubles applied to the heavy electrical engineering works, which are now all in the hands of the State Electrical Trust, the balance concerning the Low-Pressure and Accumulator Trusts. During the year, which began with October, 1926, it is estimated that the capital outlay will reach 16,000,000 roubles, of which nearly one half will be applied to the extension of dynamo and transformer works, and the remainder to expanding the production of cables, the low-pressure works, and the accumulator factories. In general, the expenditure represents a continuation of the development works which were begun in 1925-26, as well as the establishment of new works.

Constructional Works.—The State Planning Commission has had under consideration the scheme of electrical constructional works during the current year. According to the scheme, it is proposed to lay down plant of a total of 360,000 kW, or almost twice the capacity projected in 1925-26. It is considered that this programme corresponds with the probable growth in the consumption, which amounted to 150,000,000 kWh in 1913 and had risen to 450,000,000 kWh in 1925-26. But in actual fact the plant which will be installed will not be so large as contemplated owing to the delay in the allocation or execution of the orders. Some of these are to be placed abroad, but differences of opinion exist as to the proportion of the contracts to be sent outside the country. It is estimated that the total expendiure will amount to 182,000,000 roubles, of which 85,000,000 roubles will be provided out of the Budget estimates. The amount of the work to be carried out by the home works will represent 150,000,000 roubles, so that a balance of 32,000,000 roubles will be represented by foreign orders.

Industrial Consumption of Energy.—At the present time 75 per cent. of the industrial consumption of energy is stated to be derived from the stations of the industrial establishments themselves, only 25 per cent. being obtained from regional stations. If, however, the original scheme of 1920 for the construction of large regional stations is carried out, it is calculated that by 1931-32 75 per cent. of the industrial consumption will be satisfied by the regional stations. On the other hand, some industrial consumers wish for the modernisation of their isolated installations, and point to the necessity for the scrapping of a great deal of the existing plant and the substitution of new boilers, engines, &c., at a cost of 500,000,000 roubles spread over a period of five years.

Steam Turbines.—The Leningrad Metallurgical Works is reported to have been successful in constructing large steam turbines, in particular one of 10,000 kW for the Southern Steel Trust. In connection with this matter, the question of entrusting the works with other orders has been brought forward. The General Electrical Commission considers that negotiations should now be begun with the competent organisations with a view to allocating to the Leningrad works orders for two 10,000-kW turbo-generators for the Novorossisk station, one of the same size for Kieff, and one of 5,000 kW for Saratoff. It is also suggested that two 20,000-kW turbines should be ordered from the works in question.

It is announced from Leningrad that the Swedish firm which supplied the four turbines for the Volkhoff hydro-electric works has offered to deliver four turbines of 40,000-45,000 h.p. on the Kaplan system for the proposed hydro-electric works on the Svir. On the other hand, the Metallurgical Works in Leningrad has proposed the adoption of its system of hydraulic turbines for this particular station. If this should be agreed to, it would enable the works to develop this type, especially as the production of hydraulic turbines is considered to be of great importance to the country.

A High-Pressure Laboratory.—The Physical-Technical Institute in Leningrad has opened a high-pressure laboratory, which is the first of its kind in Soviet Russia. It is devoted to the investigation and testing of materials and insulators and the transmission of energy. The necessary transformers have been ordered from Germany.

Standardisation.—Work in connection with standardisation is said to be proceeding on a larger scale in the electrical industry than in other branches. Efforts in this direction are now being devoted to machines, transformers, cables, and installation materials.

Breakdowns of Plant.—In the third week in November breakdowns of turbines and generators are reported to have taken place almost simultaneously at three of the stations which supply Leningrad with energy, one of the sets being quite new and of 10,000-kW capacity.

Proposed Hydro-Electric Works.—It is announced from Petrozavodsk, Carelia, that the local Economic Council has prepared a scheme for the construction of a hydro-electric works on the River Vige for meeting the requirements of the metallurgical and electro-chemical industries. The expenditure is computed at 17,000,000 roubles. A report from Novgorod states that investigations have been completed for the establishment of seven hydro-electric works on the River Mste of a total of 35,000 h.p., one being of 15,000 h.p.

Ukraine Extensions.—It is reported from Kharkoff that approval has been given to a scheme for the electrification of the Ukraine. It provides for increasing the capacity of the

communal, industrial, and rural stations from 140,000 kW to 340,000 kW. Four regional stations are already under construction in the Ukraine of a total of 106,000 kW, and preparations are being made for the establishment of four other stations.

Kuban Stations.—The North Caucasian Planning Committee has decided on the necessity for the construction of a station of 10,000 kW in Krasnodar and one of 20,000 kW in Novorossisk.

Importation of Electrical Goods.—*Reuter's* Trade Service (Moscow) says that it is officially announced that the recently-formed Elektroimport Company has now begun activity. The shareholders of the new company are the Supreme Economic Council, the Trade Commissariat, and several Electricity Trusts. Large purchases are to be made in Germany, where credits have been granted to the company, and orders will also probably be given to French, British and Swedish firms. In addition to electrotechnical plant and articles, the company will import boiler plant for electrical power works.

The Volkhoff Station.—Experimental transmission of energy from the Volkhoff hydro-electric works to Leningrad took place in the first half of November, and it was expected that a supply from the sub-stations would be available for the network in Leningrad by the end of the month. The transmission pressure is 115,000 V.

Orders for Abroad.—The Government authorities are reported to have recently placed a number of important contracts in Czecho-Slovakia. Among them is one for a large steam turbine for the State power station at Krasnojarsk, to be built by the Erst Brunner Maschinenfabrik, Brunn, and another for three steam turbines for the Elektrotrust, to be constructed by the Skodawerke Co., Pilsen.

In connection with the guarantee credit of £15,000,000 opened by the German Government, it is stated that the Soviet trading delegation in Berlin has placed orders with various German firms for the delivery of plant of a total of 214,000 kW. The orders are said to include one set of 44,000 kW, three of 22,000 kW, and a number of sets of from 10,000 kW, downwards to 3,000 kW, 20 rolling mill motors of from 700 to 2,600 h.p., and a large number of motors of small powers.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

A New Overhead Fuse.

One of the chief objections to aerial fuses used for the protection of services tapped from overhead distribution lines is overcome, it is claimed, by a recent production of MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1, the "9609" aerial fuse for 30-A, 250-V

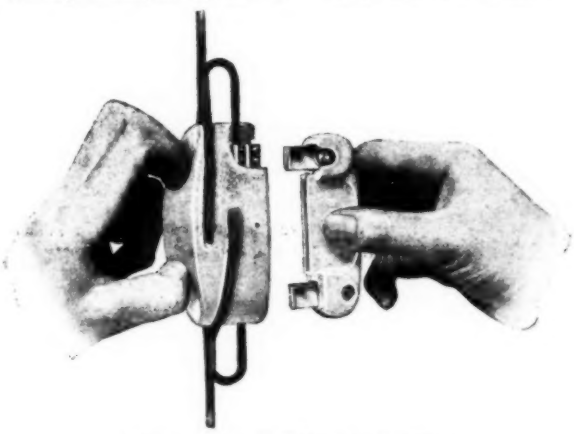


Fig. 1.—A New "Henley" Aerial Fuse.

circuits, fig. 1. It is fitted with a withdrawable fuse carrier. It is evident from the enlinking arrangement of the fuse terminal loops of the line that, in the event of the porcelain getting broken, there is no possibility of a line wire falling to the ground. To prevent interference by unauthorised persons provision is made for sealing the fuse, there being holes in the porcelain through which a sealing wire can be threaded. Finger grips in the fuse base not only give protection when operating the fuse, but make the withdrawal a very much easier matter for the linesman. The fuse carrier is of the same pattern as that used in the 30/60-A range of "Isco" cut-outs.

A Portable Transformer Station.

An interesting exhibit at the recent Water Power Utilisation Exhibition in Basle, Switzerland, was a travelling transformer station shown by the Italian State Railway authorities. The machine, which was built by the OFFICINE DI SAVIGLIANO, of Turin, is mounted on a double-bogie truck, and is equipped with apparatus for transforming from 100,000 to 3,700 V. The normal capacity is 2,250 kVA, and the maximum 2,600 kVA. The machine, one of an order for 30 of its type, is intended for use in the case of breakdown at any of the permanent transformer stations, or in the event of any unusual load on a section of the railway system, which often occurs during the grape harvest in the Italian vineyards. In order that no damage shall be sustained to the terminals and connections of the transformers during transit its speed is limited to 30 m.p.h. The station weighs about 90 tons.

Motor-Starting Equipment.

In connection with the design of contactor starting equipments, the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has recently embodied many refinements in the construction of such apparatus, with a view to enabling the most intricate functions to be efficiently performed by unskilled labour. D.c. contactor starting panels are being made in the wall-mounting pattern for motors of 20 h.p. and over, and in the floor-mounting pattern for large machines. Fig. 2 shows a pillar-type panel complete with glazed inspection windows and front opening doors; the resistance is mounted behind the slate panel and the unit is entirely self-contained. These panels can be equipped for push-button, thermostat or other forms of operation. It is claimed that they are suitable for starting motors up to 40 times per hour against a starting torque of either 60 per cent. or 100 per cent. of the full load torque, providing the aggregate starting time does not exceed two minutes in fifteen. The rating and number of the resistance steps comply with the B.E.S.A. specification. With current-limit control the time of starting is automatically gauged by the load conditions, the motor starting up quickly on light, and slowly on heavy, loads. Where the load conditions permit, or a constant starting period is required, time-limit relays are provided, the time of starting being "set" for a definite number of seconds; this is effected by means of a solenoid plunger controlled by an oil dash-pot. Overload relays may be supplied with trip contacts arranged for electrical, hand or self-resetting, and fitted with or without adjustable time-lag attachments. The panels can also be utilised for variable-speed motors, but when the speed range

Fig. 2.—A D.C. Pillar-type Panel.

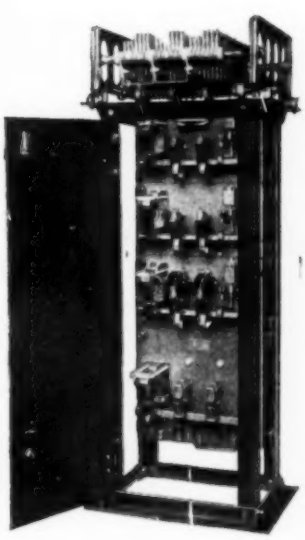


Fig. 3.—An A.C. Starting Panel.

exceeds 15 per cent., it is necessary to interlock the rheostat with the "start" push button, or fit a field relay, to ensure the motor starting up on full field.

Fig. 3 shows an a.c. panel which can be made either for star-delta auto-transformer, or rotor starting. The rating of the star-delta type is suitable for starting squirrel-cage motors

against 33 per cent. of full-load torque; the auto-transformer type is for use when a torque greater than 33 per cent. of full load torque is required, with a normal period between successive starts of approximately 15 minutes; and the rotor starting panels will start motors up to 40 times per hour against either 60 per cent. or 100 per cent. of full load torque, provided the aggregate starting time does not exceed two minutes in fifteen.

Electrical Mine-Signal Indicators.

Among the equipment displayed by Messrs. Hopkinsons, Ltd., Huddersfield, at the recent Cardiff Engineering Exhibition, was mine-signalling apparatus, and one apparatus shown was an electrical indicator similar to that depicted in fig. 4.

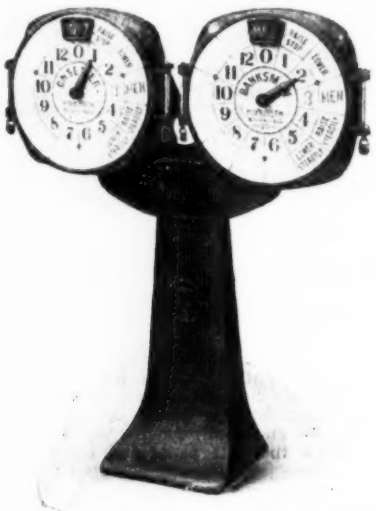


Fig. 4.—A Hopkinson Electrical Mine-Signal Indicator.

This is for installation in the engine house, and the particular example shown has two dials, but as many as five dials can be mounted on one stand. The apparatus conforms fully to the requirements of the Mines Department; it is non-cumulative and adapted for high-speed operation. The pointers are interlocked, and the "new" signal remains on until the wind is completed. Bells are combined with the gear to provide audible as well as visible signals.

High-Pressure Indicators.

A German company has recently introduced three new pieces of h.p. apparatus, a portable h.p. current indicator, a travelling-wave, and an earth-leakage indicator. The operation of the first depends on the creation of oscillations in a valve, so that it is effective at a distance. A pressure of 1,000 V can be indicated, it is claimed, at a distance of 3.25 ft. from the conductor, and one of 100,000 V at a distance of 65 ft. The apparatus works on the closed-circuit principle, and is claimed to be exceedingly reliable owing to the absence of auxiliary apparatus. The travelling-wave indicator comprises a valve system of connections through which the unusually short duration of the phenomenon is excited to such a degree that an ordinary relay may respond. This apparatus may also be used in conjunction with a recording device. The earth-leakage indicator is a similar piece of apparatus capable of indicating disturbances of only one cycle per second.

An Internally-Threaded Gallery.

With a view to the saving of time and trouble in the fixing of the shade gallery to the electric lampholder, Mr. John Singleton, Penn Fields, Wolverhampton, has produced an internally-threaded gallery, fig. 5, for direct screwing on to

Fig. 5.—Screwed Gallery.

the holder. An important claim for this device is its increased security when in position. It is known in the usual patterns adopted for the ordinary gallery.

An Improved Lampholder.

To meet the demand that exists for a heavier lampholder than the "Economic" pattern, and one less expensive than the 'Excel" model, the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has produced a new medium-weight lampholder. It is known as the "New Standard," and has a cast dome and cordgrip cap and heavy-gauge clamping and shade-carrier rings. The threads on the liner, dome and rings are well cut. The interior is of the standard G.E.C. "S" pattern steatite, which, in addition to its insulating properties, is very strong mechanically. The plungers are fitted with phosphor-bronze springs which, it is claimed, will not rust or lose their resiliency under the influence of heat. The holder is well finished.

The Electricity (Supply) Bill.—IV.

Proceedings in the House of Lords.

On December 7th, the House of Lords considered the Electricity (Supply) bill on report.

On Cause 1 (Construction of Central Electricity Board) an amendment, moved by Viscount Peel, to provide that the chairman or any member of the Board should, within three months of his appointment, sell any securities "in which he may be beneficially interested" instead of any securities "which he may hold for his own benefit" was agreed to. Viscount Peel explained that the object of the amendment was to extend the duty under the clause as regarded securities held by nominees. Viscount Peel also moved a further amendment laying it down that a quorum should be not less than one-third of the full number of the Board. The amendment was agreed to.

The Lord Chancellor moved the insertion of the following new sub-section:—"Where the chairman or other member of the Board becomes disqualified for holding office or is absent from the meetings of the Board for more than six months consecutively, except for some reason approved by the Minister of Transport, the Minister shall forthwith declare the office to be vacant, and shall notify the fact in such manner as he thinks fit, and thereupon the office shall become vacant." The amendment was agreed to.

On Clause 4 (Preparation and carrying out of scheme), Lord Montagu of Beaulieu moved that one of the objects of the scheme should be:—"Determining the places at which transformers for reducing pressure and secondary lines shall be placed by the Board as part of the main transmission lines, and the pressure at which electricity shall be supplied by the Board from such transformers and secondary lines." He said that scientifically and economically there was not the least chance of cheap electrical current in the country and small industrial districts unless the burden was laid on the Commissioners and the Board of building transformer stations, and supplying current to the local distributors.

Viscount Peel said that the matter of setting up transforming stations was one for arrangement between the Board and the distributors. The transformer stations would be paid for in the same way as the other operations of the Board by the charges made on the sale of electricity.

The amendment was withdrawn.

Sub-section 1 of Clause 6 (new selected stations) reads as follows:—"The Board may make arrangements with any authorised undertakers in whose area of supply, or in the neighbourhood of whose area of supply, any new generating station required by a scheme is to be situated, for the provision of such station, but where such area of supply is situate in an electricity district for which a joint electricity authority has been constituted, the Board shall first endeavour to enter into arrangements with the authority for the provision of such station."

Lord Oranmore and Browne moved to omit all the words after "station," beginning "but where such area of supply." He said it seemed a pity that the Board should be hampered by being obliged to go first of all to the joint electricity authority.

The amendment was agreed to.

On Clause 13 (Limitation of price to be charged on owners of selected stations), Lord Gainford moved an amendment to provide that where a power company was prejudiced by the fact that the Board had selected one of its stations, and thereby affected the cost of running, other stations in its area, it should be entitled to make a claim.

Viscount Peel said he could not see how a power company could be damnified in respect of a selected station.

The amendment was negatived by 54 votes to 24.

After Clause 18, Viscount Peel moved to insert the following new clause, which was agreed to:—

(Special provisions as to London)—"Where any obligation to carry out any technical scheme imposed on a joint electricity authority, local authority, company or body by or

under the London and Home Counties Electricity District order, 1925, or the London Electricity (No. 1) Act, 1925, or the London Electricity (No. 2) Act, 1925, conflicts with any obligation arising out of a scheme under section 4 of this Act which is imposed by or under this Act, on any such authority, company or body, the last-mentioned obligation shall prevail."

Sub-section 1 of Clause 19 (Application of Electricity Supply Acts to Board) reads:—"Subject to the provisions of this section, the Board shall be deemed to be undertakers and authorised undertakers within the meaning of the Electricity (Supply) Acts, 1882 to 1922, and this Act in relation to the Board shall be deemed to be a special Act for the purposes of those Acts, and for the purposes of this section there shall be incorporated with this Act the provisions of the Schedule to the Electric Lighting (Clauses) Act, 1899, subject to such exceptions and modifications as may be prescribed by regulations made by the Electricity Commissioners:

"Provided that sections two and three of the Electric Lighting Act, 1888 (which relate to the purchase of undertakings by local authorities) shall not apply to the undertaking of the Board."

VISCOUNT PEEL moved the addition of the following words: "and that section twenty of the Schedule to the Electric Lighting (Clauses) Act, 1899, in its application to the Board, shall have effect as if after the words 'electric signalling communication' wherever they occur, there were inserted the words 'or electrical control of railways.'" The amendment was agreed to.

On Clause 20 (Acquisition of land by the Board), the following new sub-section, moved by VISCOUNT PEEL, was agreed to: "Provided that the Electricity Commissioners shall not make and the Minister of Transport shall not confirm any special order authorising the Board to acquire land or a right in or over land compulsorily for the purposes of a main transmission line unless satisfied that the objects sought to be attained cannot consistently with efficiency and economy be attained by the acquisition of a wayleave in accordance with the provisions of section twenty-two of the Electricity (Supply) Act, 1919."

The following new Clause, moved for insertion after Clause 22, by VISCOUNT PEEL, was agreed to:—

(Protection of Government observatories, &c.)—"The Board shall not provide, construct, equip, or alter, or use any generating station, sub-station, transformer station, building, plant, machinery, electric main, appliance work, or apparatus, or use or permit to be used, transmit, convert, or transform any electrical energy either under this Act or otherwise in such a manner as to affect injuriously in any respect whatever, either by vibration or obstruction or smoke, or by electric or electromagnetic action or influence, or by any means whatsoever, whether similar to those enumerated or not, any Government observatory or laboratory existing at the passing of this Act, or any instrument or apparatus in or adjacent thereto, and used in or in connection therewith."

On Clause 30 (Relation of charges to dividends), an amendment, moved by LORD ASKWITH, to provide that the Electricity Commissioners should consider the very different position held by the distributing companies as compared with the power companies was agreed to.

On Clause 41, VISCOUNT PEEL moved a new sub-section to enable the Board to go to the Railway and Canal Commission and ask for supports in a mining district. The amendment was agreed to, as was the following:—"Where an application has been made to the Minister of Transport for his consent to the placing of any electric line above ground, and representations are made that the line will prejudicially affect any ancient monument within the meaning of the Ancient Monuments (Consolidation and Amendment) Act, 1913, the Minister of Transport, in determining whether to give or withhold his consent, or to impose conditions, shall take into consideration any recommendations made to him by the Commissioners of Works with a view to preventing the ancient monument being prejudicially affected."

This concluded the report stage.

On December 10th VISCOUNT PEEL moved the third reading of the Bill.

LORD MONTAGU OF BEAULIEU strongly criticised the Bill, and said that scientific opinion was entirely against it. Means of power generation would be available in the near future which might render the use of electricity on our long-transmission lines uneconomic. Six of our biggest industries—shipping, coal-mining, railways, cotton, agriculture, and road transport—would not be affected by the Bill. This country could never hope to produce electricity at anything like the low cost at which it was produced in other countries. He deprecated Government interference with the electrical industry, believing that it could only lead to trouble and waste of public money.

VISCOUNT PEEL said the general experience was that, as new forms of power became available, they did not entirely displace old forms of power. He believed that developments in gas and electricity would be complementary. In any case, the country had electricity at present, and, that being so, it should be produced on the largest possible scale and at the cheapest possible cost, and in the light of the highest scientific knowledge. This country was compact and highly industrialised, and should be able to produce electricity usefully and cheaply.

The Bill was read a third time.

On Clause 1 (Constitution of Central Electricity Board), LORD BERTHE OF THAME moved an amendment to enable the Minister of Transport to declare the office of a member of the Board vacant if the member "fails to comply with the provisions of the foregoing section." This was agreed to.

On Clause 24 (Protection of Government observatories), VISCOUNT PEEL moved an amendment to safeguard the position of the Admiralty with regard to its new wireless stations. This was agreed to.

On Clause 29 (Power to Treasury to guarantee loans to the Board) an amendment, moved by LORD ASKWITH, was agreed to providing that the loans should be guaranteed subject to such conditions as the Treasury might lay down.

On Clause 39 (Provisions as to companies with large areas of supply), VISCOUNT PEEL moved the addition of the following proviso, which was agreed to:—"(ii) Where the area of supply is not situate wholly or mainly within the district of a joint electricity authority but is situate wholly within the district of a single local authority, the right of purchase shall be exerciseable by that local authority."

Clause 47 deals with the supply of electricity to railway companies, and the proviso to the clause reads:—"Provided that such company or authority shall not supply to any other persons electricity supplied to them under this section and such electricity shall not be used on any part of the premises of such company or authority which is not in their occupation."

VISCOUNT PEEL said that he accepted the proviso at an earlier stage, in order to protect the rights of the undertakers in supplying electricity to the railway companies, but the proviso went too far, because it to some extent infringed the rights of the companies. He moved to substitute the following new proviso, which put the matter right, and assisted the undertakers without taking away any of the existing rights of the railway companies:—"Provided that no such supply shall, without the consent of the Minister of Transport, be used by such company or authority for purposes of lighting, other than the lighting of vehicles or stations and other premises in the occupation of such company or authority." The amendment was agreed to.

On the motion that "This Bill do now pass," VISCOUNT PEEL said it might be possible, when the amendments to the Bill came back from the Commons, to give the names of the members of the Central Board.

The Bill was then passed.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Relief Bolts and Flame-Proof Enclosures.

My attention has been drawn to Mr. Amberton's letter which appeared under the above heading in your issue of November 5th, and I reply to his remarks in the order in which they are made.

With reference to Mr. Amberton's flat contradiction of my statements as to the scope of my article, "Vents Applied to Flame-proof Motors," it would be idle for me to argue the point further, because the answer lies in the article itself, which interested readers have seen, or to which they can refer.

Transcending Mr. Amberton's discourse on his ideas that I lack experience of relief bolts and am under a misapprehension regarding their ancient history, I find his statement that relief bolts were first introduced in 1921—a disputation which, I think, can only exist in the mind of Mr. Amberton, because of the interest which most of the larger manufacturers of oil switches took in these devices much earlier. For instance, Messrs. Siemens provided relief bolts on oil switches as far back as 1910.

Mr. Amberton evades the point at issue in the matter which he next discusses, namely, that with flameproof enclosures provided with relief bolts, explosion pressures are found to be higher with the relief bolts operative than when they are rendered inoperative by wedging open the escape gap. This is not an imputation that the release secured with relief bolts may not be sufficient to prevent a dangerous rise of pressure. It is merely a disadvantage inherent in relief bolts which designers must take into account when estimating possible pressure rises from the escape area/volume ratio. Further, it has been my contention that the selection of the type of release appropriate for motors is made principally in view of those aspects of the case which are apart from explosion pressure; and in this matter surely Mr. Amberton is failing to admit of a necessary differentiation between the respective treatments required by motors and switchgear.

With reference to Mr. Amberton's peculiar statement that I am on dangerous ground in mentioning the use of jointing material on flame-proof motors working in extremely wet conditions, I merely described the usual practice. Actually the makers of the plant illustrated in my article conferred last year with the Chief Electrical Inspector of Mines on the matter of water-tight jointing, and the jointing they are using has been selected with regard to his recommendations. In some sites, mining-type motors have to operate with their cases drenched with water (coal-cutter motors, in some pits, are regularly hauled through several inches of water). In

such cases it is useless for Mr. Amberton to state that he does not agree with the use of jointing material, because without this protection motor windings would not stand up for any reasonable period.

I cannot agree that the possibilities of the jointing being blown out, or not being replaced, can be advanced as objections to the use of water-tight jointing, as such an unlikely contingency would not involve any risk of external ignition, and would only leave the plant no worse off than if the jointing had been omitted in the first place. But correct jointing does not blow out; and colliery electricians take particular care to replace the water-tight jointings on motors operating in wet conditions.

As regards Mr. Amberton's admitted failure to comprehend the object of fitting water-tight jointing to a motor when at the same time a constant-aperture vent is provided, for a detailed explanation of this I refer Mr. Amberton to my article, and would assure him that it is done for somewhat similar reasons that a builder will provide constant ventilating means in a building and still take good care to make the roof and walls weatherproof.

Mr. Amberton concludes his remarks by admitting that, while relief bolts could not replace constant-aperture vents in cases where they have been fitted for what he terms "ulterior objects," he regards the logic as attenuated. I reply that I have not encountered such doubts in mining electrical circles because of the following reasons:—

(1) Constant-aperture vents in favourable locations are made to act as inlets and outlets for air circulated to cool the motor. A plain continuously-rated totally-enclosed motor (excluding double-air-circuit motors) will only give from 30 per cent. to 45 per cent. of the horse-power it would give if it were of open type. This represents, I think, a very big scope for economy, particularly when it is consistent with the following second advantage.

(2) It is recognised that plain totally-enclosed motors operating in wet conditions give a considerable amount of trouble owing to their developing low insulation resistance which in time may cause failure. I have found that it is quite a common practice among electricians in such cases (provided, of course, it is in a place where Rule 132 does not apply) to remove one or more covers, protect the openings from dripping water, and run a shift or more in that way. The degree of ventilation so afforded results in a good drying-out of the motor, and time after time I have seen responsible colliery engineers raise the question:—As running with covers off removes their trouble, why not fit a permanent amount of correct ventilating means as a preventive measure against declining insulation values?

It has been to meet these demands that at least five leading manufacturers of mining motors now provide constant-aperture vents as standard to their machines; but although I have frequently seen all of these various makes of motors operating in pits, I have yet to see the first motor with relief bolts fitted as the standard of any maker.

Percy Huggins.

Wakefield, *December 10th*, 1926.

[This correspondence is now closed.—Eds. Elec. Rev.]

Electricity Supply in Liverpool.

If Mr. P. J. Robinson thinks that I have misquoted him both in statements and figures, why does he not correct them? I would refer Mr. Robinson to the Electrical Review reporting his address to the Mersey, &c., Centre of the I.E.E. My letter was in answer to the report of Mr. Robinson's address which appeared in the *Liverpool Daily Post* on October 26th, 1926, to which paper I replied, but I was very sorry to find that my letter did not appear in the Press, an action which was very unfair, and can only be condemned by any right-thinking man.

It is gratifying to know that the Electrical Review is a *free Press*.

I am fully aware that alternative sites were investigated, and I think it a very lame excuse for Mr. Robinson to hide himself behind the fact that the Electricity Commissioners sanctioned the extension of Lister Drive. I am convinced that the Electricity Commissioners were compelled to sanction this extension very much against their own wish, as no doubt they were very disgusted with the breaking-up of the Mersey and West Lancashire Electricity Area, an action entirely due to the Liverpool Corporation.

I await with interest Mr. Robinson's corrected figures.

N. H.

Ainsdale, *December 7th*, 1926.

Variable-Speed Three-Phase Motors.

Referring to a reader's question under the above heading, in your issue of the 3rd inst., I would like to point out that no helpful answer can be given to the query unless at least a rough chart of the fan's yearly working conditions is given. From such a chart the choice between a commutator and an induction motor can be easily made from the following considerations:—

First of all, in either case the motor cannot be direct-coupled to the fan because the induction motor cannot run at 2,000 r.p.m., this being above its best synchronous speed (1,500 r.p.m.), while the commutator motor of this size would hardly be satisfactory at a speed above 1,000 r.p.m.

In either case, therefore, the motor must drive by belt or gear, and on this score the induction motor is preferable as it would give its maximum power at a higher speed than the commutator motor would.

A commutator shunt-type motor controlled without resistance loss by a special separate induction regulator from standstill to any desired speed is made in this country by the Electro Dynamic Construction Co., Ltd.

The principal merits of this motor are higher power factor, or leading current; shunt characteristics at all speeds, as compared with the series characteristics of the induction motor controlled by rotor resistance; stability as against instability of the induction motor when working much below synchronism.

On the other hand this type of motor costs considerably more than an induction motor, and has a lower efficiency near synchronism, and its commutator needs more attention than the induction motor's slip rings.

If your reader is not interested in power factor at small loads, the only consideration in making the choice is the power bill he has to pay as against first cost. For an ordinary constant-torque drive, owing to the question of stability and efficiency, the choice would quickly be made in favour of a commutator motor. In the case of fan driving, however, the power falls quickly with the speed, and so does the power wasted in resistance if an induction motor is adopted. Moreover, the series characteristics of the motor do not affect the stability of the drive. The choice therefore must depend on the way the fan is used.

As a general guidance, let me consider three fan speeds, namely, 2,000, 1,400, and 1,000 r.p.m. The respective powers of the motor would be approximately 40, 14, and 5, and the kW input 33.5, 16.5, and 9 for the induction motor, and 35, 14, and 7 for the commutator motor.

Your reader, assuming a chart of the fan speeds during a year's working, can, from these rough figures and by interpretation, work out how much he would save after allowing about £150 extra for the first cost of the motor and a little extra for maintenance and depreciation.

N. Pensabene-Perez.

London, *December 6th*, 1926.

Scrapping Old Plant: Would it Pay?

Replying to the letter of "Works Electrician" in your issue of December 3rd, the indicated horse-power which would have to be developed by a modern high-speed direct-coupled generating set when running on a load of 1,280 amperes at 220 volts would be 490 i.h.p. only, as against 556 i.h.p. on the present engine. This shows a saving of 66 i.h.p.

Unless the present engine is of particularly economical character it would certainly be worth while to replace the present arrangement with a 300-kW direct-coupled generating set, and if he cares to communicate with my firm it will be pleased to put forward a scheme which he will find of moderate price and economical.

F. O. L. Chorlton.
(Ashworth & Parker).

Bury, *December 6th*, 1926.

"Works Electrician," in the correspondence columns of the Review of December 3rd, 1926, leaves rather a lot to one's imagination from the specification point of view. However, his total load appears to be about 294 kW at 220 V. Size for size, in the last 20 years no material improvement in efficiency has been effected in d.c. dynamos. Presumably our friend's machines are within the carbon-brush epoch, and quite possibly are of the interpole type, whilst his i.h.p. is recorded as being 556. A reference to my horrible past discloses the fact that, amongst other things in the year 1901, I was engaged in testing three similar types of 300-kW, low-speed, steam-driven generators at 94 r.p.m., direct-coupled, the prime movers being horizontal cross-compounded Corliss condensing engines. Whilst doing full load the average i.h.p. was, say, 460. The overall efficiency per set was about 87 per cent., vacuum 24 in.

From the above figures it is an easy deduction that somewhere between "Works Electrician's" cylinders and his terminals there is a loss of about 100 h.p. Where is this loss? As my sets consumed about 23 lb. of water, from and at 212 deg. F. per kWh, it may be assumed that "Works Electrician" evaporated about 2,300 lb. of water unnecessarily. If he converts this into coal, the £ s. d. equivalent may be apparent, which will show appreciable economy in favour of his single 300-kW proposition.

Personally, I consider that without putting our friend out of a job, the strongest possible case could probably be made out in favour of purchasing his "juice" from an outside source.

W. E. Rogers, A.M.I.E.E.

London, *December 12th*, 1926.

The Fire Hazard of Large Transformers.

In your issue of the 10th inst. your contributor, Mr. C. H. S. Tupholme, refers to large relief pipes fitted to the conservator tanks of B.T.-H. transformers. It seems to me that this is an error, as the usual place for the mounting of an oil relief pipe is actually on the main transformer tank, and not on the conservator tank. Relief pipes so fitted are standard

practice on transformers made by the G.E. Co. (America), Westinghouse, Brown, Boveri, &c., and we believe this is the practice with B.T.-H. transformers also.

When it is remembered that an oil conservator is connected to the main transformer tank by one pipe only, usually of about 1½-2 in. bore, it will be easily understood that a vent pipe—usually about 4-in. bore—attached to the main tank is much more effective than any vent on the conservator drum can possibly be for release of internal pressure.

The diaphragm generally employed is of glass clamped up between cork gaskets suitably treated so as to make a tight joint.

Transformer.

December 12th, 1926.

The Power Supply of Wireless Sets.

It would be interesting to have particulars of the wet h.t. battery which has served Mr. Hewlett so well, because one would expect this type to be highly economical. But my experience is otherwise.

Some two months ago I set up 50 cells of about the most reputable make. The sizes of the parts appear to correspond with those used in the *large* size dry h.t. batteries of the same make. Having had some experience of Leclanché batteries, I monopolised the kitchen for two long evenings in waxing the tops of jars and zincs, setting the cells in paraffin wax, assembling, filling, connecting-up, and cleaning. So there has been no contamination, leakage, or creeping at all. The battery was used on a 2- or 3-valve set for a few hours most evenings, and the voltage, plate current, and internal resistance were checked regularly with a M.C. instrument. Within a week the voltage per cell was below 1, and in a month it fell below ½, with 5 milliamperes passing. I then renewed the electrolyte in some cells and removed the worst of the deposited crystals. There had been little evaporation. This week I have had to scrap the lot; they were not even pulling their weight. Throughout their life they were in series with a number of dry cells of similar size and make which had had some previous use. These still show 1 V each.

As regards this hope of economy, I am, therefore,

Disillusioned.

December 6th, 1926.

With reference to Mr. H. Hewlett's letter appearing in the current issue of the ELECTRICAL REVIEW under the above heading, I was very surprised to hear that he had had such excellent service from Leclanché cells for the h.t. supply to a wireless set.

My experience with this type of cell has been very disappointing.

A short time ago I fitted up a battery of 50 cells (each approximately 1 in. dia. by 2½ in.) for use with a 2-valve receiving set. The cells were set in paraffin wax, and the jars and all connections were thoroughly waxed with a view to preventing, as far as possible, capillary action.

After a few weeks' service the voltage dropped to less than one volt per cell, and after about seven weeks the voltage for the 50 cells fell to about 12.

The cells were dismantled and thoroughly cleaned, and the zinc elements were scraped clean, but after the battery had been in service for a further three weeks, most of the sacs and zincs were crystallised up practically solid.

The battery has now been scrapped.

A. J. Young.

Loughborough, *December 6th*, 1926.

In reference to Mr. Hewitt's letter in your last issue, I realise that the h.t. accumulator must be properly treated to ensure good service, but I should imagine that Leclanché cells would at least require an equal amount of attention.

Most established retailers tell the purchaser of an h.t. accumulator to bring it back to be recharged at a certain date. Of course, the time stated will be comparatively short for the "first charge" period.

The length of time quoted for further charges will depend on the Ah capacity and the number of valves used. I am surprised that this system, which I thought was fairly general, has not been carried out in the district in which your correspondent's business is situated. Were it so the retailer would be encouraging the kind of customer who is satisfied and calls again. With regard to cost, in the article I selected the most costly type of h.t. battery, and naturally, to be fair, compared it with the most expensive kind of h.t. accumulator. As a matter of fact, I know several listeners who possess 3- and 4-valve sets and have been using quite successfully three 20-volt units of a well-known make of h.t. accumulator, the total cost of which is 45s.

A. E. Irwin.

Leafield, *December 6th*, 1926.

A Simple Test for High Pressure.

The following true story of an incident which happened during the ordinary mains routine of a large concern in this country may be of interest.

A Bengali foreman of eight years' experience in charge of an underground service set, consisting of two mistries (skilled (?) workmen) and some 20 coolies, was given particulars of a service to be laid to a certain house. Following the usual routine the engineer visited the job about three hours afterwards, and was very much surprised to find all the men sitting down and no work being done. Further inspection revealed the ground open and a c.i. gutter broken, exposing two v.b. cables, with a pair of test lamps connected across them and burning brightly.

The foreman was found inside the house, and on being asked the reason for the delay, he gave the following explanation:—

"Sir, I excavated the ground and found a gutter, which I broke open, to discover only two very thick cables instead of the usual three thinner ones. Therefore, I think this may be a high-tension cable, so I connected the test lamps across. *If it is high tension the lamps will burn out, and if it is low tension they will be all right. They have been burning for two hours now so I think it must be low tension.*"

Not the least part of the grim humour lies in the fact that the *mistry* connected the test lamps, perhaps by standing on a wooden board, under the foreman's orders. The foreman has also passed some well-known examinations of a home institution.

D. D.

Calcutta, India, *November 15th*, 1926.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Communication with South Africa.—On December 7th, Sir H. BRITTAIN asked the Postmaster-General whether any arrangements were in hand for the erection of beam stations in other parts of the British Empire following that now being completed for communication with South Africa.

Lord WOLMER said that the agreement with the Marconi Company provided for the erection in this country on behalf of the Post Office of beam stations for communication with corresponding stations in Canada, Australia, South Africa and India. The stations for the Anglo-Canadian service were now operating; the stations for the Anglo-Australian service were undergoing preliminary trials and were expected to be ready for the official tests in a few weeks; the stations for the Anglo-South African and Anglo-Indian services would, it was hoped, be completed early in the New Year.

Special Orders.—Special Electricity Orders have been approved relating to the Isle of Wight; Uphill, Somerset; Barkisland, Midgley, Rishworth, Scammonden, and Soyland, part of Sowerby, Todmorden, and Norland and Upper Greetland, West Riding; parts of the counties of Gloucester and Warwick; the burgh of Dingwall, the parishes of Dingwall, Fearn, Nigg, and Tarbat, and parts of the parishes of Roskeen, Alness, Kiltearn, Fodderty, Contin, Urquhart, and Logie Wester, Urray, Kilmuir Easter, Logie Easter, Edderton, and Tain, Ross and Cromarty; and parts of the rural districts of Maidstone, Malling, and Hollingbourn, Kent.

The Electricity (Supply) Bill.—In the House of Lords, on December 10th, this Bill was read a third time and passed.

Legal.

The Metalite Co., Ltd., v. The Reliance Electric and Maintenance Co.

THIS matter came before Mr. Registrar Dell in the Mayors' and City of London Court, on December 9th. The plaintiffs sued the defendants for £34 for goods supplied and sold. The defendants admitted the debt, but sought to deduct £8 for goods returned. Judgment was given for plaintiffs for the amount claimed, payment to be made by December 16th.

Aberdeen Suburban Tramways Co., Ltd., v. Aberdeen Town Council.

AT the meeting of the Aberdeen Town Council a summons was presented by the Aberdeen Suburban Tramways Company against the Corporation for the payment of £26 800 for alleged loss and damage as a result of the operations of the Corporation in connection with the construction of a new aqueduct from Invercannie to Mannofield. The matter was remitted to the Finance Committee of the Council. The Aberdeen District Committee of the County Council, at a meeting the following day, agreed to allow the road surveyor to be precognosed on behalf of the Corporation.

X-Rays, Ltd.

MR. JUSTICE TOMLIN, in the Chancery Division, on December 7th, sanctioned a petition for the reduction of the capital of X-Rays, Ltd., from £75,000 to £24,265 2s. 0d., by reducing the £1 preference shares to 5s. each and the ordinary shares to 6d. each. The petition stated that the company was incorporated in 1908 for the manufacture of all kinds of electrical apparatus, especially in connection with X-rays, and carried

on business at Torrington Place, W. The company had lost sums amounting to £50,513, and it was proposed to cancel capital to this extent and make the necessary adjustments.

HIS LORDSHIP said that upon the evidence, it did not appear to him certain that the preference shareholders, whose rights were altered by the petition, had had any opportunity of voting for or against the resolution for confirming the reduction of capital. He adjourned the petition for another meeting of preference shareholders to be held.

J. G. White & Co., Ltd.

IN the Chancery Division, on November 16th, Mr. Justice Tomlin confirmed the reduction of this company's capital from £350,000 to £106,000.

Engineering Firm Fined for Breach of Regulations.

IN the Sheriff's Court, Dumbarton, last week, Sheriff Menzies imposed a fine of £50, with 25s. expenses, on D. & J. Tullis, engineers, Clydebank, who admitted a breach of the Factories and Workshops Act in relation to the regulations dealing with the use of electricity. It was alleged that the electric control wires for an overhead crane in a new foundry were not so worked as to prevent danger so far as reasonable and practicable, and that in consequence of the neglect a painter suffered bodily injury.

A factory inspector stated that the workman was at the time engaged with another painting steel girders. The injured man's mate heard a groan, and, looking round, saw the man in a stiff position with his right hand upon a live wire. The mate had the power cut off, and the injured man fell to the ground unconscious. Artificial respiration was resorted to, and the man revived. The current was at 440 V alternating, sufficient to kill any man, and it was fortunate that he escaped death. The wires should have been "dead" when men were working near them.

An agent, on behalf of the firm, pointed out the precautions which had been taken. He suggested the firm was not wilfully negligent and that the man himself brought about the accident. The firm took every precaution for the safety of its men.

The Sheriff, in imposing the fine, said the precaution pointed out in the charge was a simple and an effective one—the cutting-off of the electric current. That could easily have been done, and must have been overlooked by somebody responsible out of sheer carelessness.

Electrician Sentenced for Fraud.

THE *Yorkshire Post* reports that last week Ernest H. Hammond, electrician, was sentenced by the Bradford stipendiary magistrate to 12 months' hard labour on three charges of obtaining credit by fraud. Representing that he was just commencing business as an electrical engineer and contractor, the prisoner obtained goods from Messrs. W. F. Beardsall, Manchester, Messrs. Coglan, Ltd., Leeds, and the Sheffield Products, Ltd., Bradford, on credit for seven days or more. He persistently refused to pay for the goods when called upon to do so. Five previous convictions were proved, and it was stated that the prisoner had been acting in concert with two or three other men.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 8th. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Centralette (lettering and design). No. 472,182. Class 6. Electric suction sweeping machines.—C.C.A. (Cables and Accessories), Ltd., 83, Queen Street, E.C.3.

Lecol. No. 474,255. Class 6. Machinery of all kinds and their parts.—Lang Electrical Co., Ltd., 24, Brent Street, Hendon, N.W.4.

Egalit. No. 470,055. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Gebruder Siemens & Co., Lichtenberg, Berlin. (C. Barnard Burdon, 41, Bedford Row, W.C.1.)

Dr. Nesper. No. 471,032. Class 9. Loud speakers and parts thereof and headphones.—The S.D.H. Manufacturing Co., Colindale Avenue, Hendon, N.W.9.

Birch-Ware (lettering and design). No. 473,035. Class 8. No. 473,036. Class 50. Electric insulating compositions.—John Birch & Son, 13, Lower Brook Street, Walsall.

Eltron. No. 474,000. Class 8. Electrical resistances.—Theodore Stieber, Berlin. (H. E. Pooly, 79, Queen Victoria Street, E.C.4.)

Tromba. No. 474,233. Class 8. Electrical resistances.—S. P. Welch and J. E. C. Price, trading in co-partnership, 17, White Hart Lane, Tottenham, N.17.

Laray (lettering and design). No. 474,816. Class 8. Instruments and apparatus for use in connection with radio-telegraphy and telephony.—C. J. Elliot, 10, Queen's Road, S.W.8.

B.U. (lettering and design). No. 473,101. Class 13. Electric lamps (ordinary).—General Electric Co., Ltd.

New Electro-Osmotic Concern in Germany. — The *Deutsche Bergwerks Zeitung* learns that the Siemens und Halske A.G. and the Elektro-Osmose A.G. are about to found a new company to exploit certain electro-osmotic diaphragm processes, chief among them being those of which the practical value has already been proved in the purification of sugar, water, glue, glycerine, &c.—*Reuter's Trade Service* (Essen).

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925

15,917. "Fittings for composite electric cables and method of applying same." T. Varney and J. P. King. June 19th, 1925. (261,442.)

16,128. "Slip regulators for induction motors." British Thomson-Houston Co., Ltd. June 20th, 1924. (235,918.)

20,056. "Telephone systems." Standard Telephones and Cables, Ltd. (G. Deakin and L. Polinkowsky). August 10th, 1925. (261,456.)

20,058. "Telephone systems." Standard Telephones and Cables, Ltd. (G. Deakin and C. E. Stevens). August 10th, 1925. (261,457.)

20,618. "Telephone systems." Standard Telephones and Cables, Ltd. (L. Polinkowsky). August 17th, 1925. (261,464.)

20,703. "Telephone systems." Standard Telephones and Cables, Ltd. (G. Deakin). August 18th, 1925. (261,465.)

20,706. "Clockwork-actuated valves and electric switches." E. E. Ebdon. August 18th, 1925. (261,466.)

20,735. "Electroscopic testing devices." Hacklander & Co. and K. H. Hacklander. August 19th, 1925. (Addition to 247,284.) (261,473.)

20,835. "Tuning unit for wireless purposes." Standard Telephones and Cables, Ltd., and H. J. Gowring. August 14th, 1925. (261,476.)

20,864. "Control gear for electrically-driven washing and other machines." I. Braithwaite & Son, Engineers, Ltd., W. Banks, and W. Brooke. August 20th, 1925. (261,477.)

20,924. "Switching devices for automatic and semi-automatic telephone systems." Siemens Bros. Co., Ltd., and C. Lambert. August 20th, 1925. (Cognate application 28,626/25.) (261,481.)

21,035. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). August 22nd, 1925. (261,484.)

22,050. "Microphone amplifiers." Siemens & Halske Akt. Ges., H. Sell, and B. Langenbeck. September 3rd, 1925. (261,493.)

22,112. "Arrangements suitable for the reproduction, recording, and transmission of sound." D. C. A. Hultstrom. September 4th, 1925. (261,495.)

22,183. "Protection of electric line sections." P. C. Rushen (Siemens and Halske Akt. Ges.). September 4th, 1925. (261,496.)

23,441. "Apparatus for transmitting or reproducing sound." S. G. Brown. September 19th, 1925. (261,506.)

23,492. "Control systems for electrical apparatus such as motors." C. T. Searl and Metropolitan-Vickers Electrical Co., Ltd. September 21st, 1925. (261,507.)

23,625. "Telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. September 22nd, 1925. (261,509.)

23,739. "Method and apparatus for the electric transmission of pictures and views." British Thomson-Houston Co., Ltd. September 24rd, 1924. (240,463.)

24,458. "Electrical switches." H. Wiggin & Co., Ltd., and A. G. Lobley. October 1st, 1925. (261,516.)

25,826. "Electric heating apparatus." Automatic Telephone Manufacturing Co., Ltd., and C. H. Archer. October 15th, 1925. (261,525.)

26,000. "Safety electric hand lamps." "Ceag" Miners' Supply Co., Ltd., and R. J. Plummer. October 17th, 1925. (261,527.)

26,790. "Electric switches." Castelco Fabrik fur Elektrische Apparate und Metallwaren Ges. January 22nd, 1925. (246,443.)

27,335. "Electrolyser for the production of hydrogen and oxygen." "Montecatini" Soc. Generale per l'Industria Mineraria Ed. Agricola. November 7th, 1924. (242,635.)

29,191. "Excitation of dynamo-electric machines." English Electric Co., Ltd., and R. A. R. Bolton. November 19th, 1925. (Cognate application 30,594/25.) (261,541.)

30,088. "Damping winding in rotors of electrical machines." Thyssen and Co. Akt. Ges. July 6th, 1925. (254,675.)

30,285. "Means for holding magnetos and the like to their base." A. Page. December 1st, 1925. (261,549.)

30,572. "Electrical terminals." H. Rottenburg. December 3rd, 1925. (261,552.)

31,638. "Storage batteries." B. Ford. December 15th, 1925. (261,560.)

32,963. "Electrically-operated pressing machines." British-American Laundry Machinery Co., Ltd. (American Laundry Machinery Co.). December 31st, 1925. (261,566.)

1926.

810. "Ignition of vacuum switch tubes." Siemens & Halske Akt. Ges. January 12th, 1925. (245,883.)

1,176. "Connections for electric cables." C. F. Clare. January 15th, 1926. (261,573.)

1,301. "Electric remote control and signalling apparatus." British Thomson-Houston Co., Ltd. January 26th, 1925. (246,466.)

1,945. "Arrangement for transmitting messages along electric transmission lines by means of high frequency currents." E. Pfiffner. March 3rd, 1925. (248,714.)

3,667. "Manufacture of metal sheets by electrodeposition." A. Z. Pedersen. February 9th, 1926. (261,592.)

6,336. "Electromagnetic driving devices for use with sound-reproducing apparatus." W. H. Gerns. April 23th, 1925. (251,596.)

6,573. "Sound-reproducing apparatus." R. Brenchley. March 5th, 1926. (261,603.)

6,849. "Mounting of electrically-driven spinning centrifuges." Glanzfaden Akt. Ges. March 12th, 1925. (249,142.)

7,148. "Electric regulators." International General Electric Co., Inc. March 26th, 1925. (249,846.)

7,453. "Electric rheostats, pgentiometers, and the like." W. F. Harkness and F. Davies. March 17th, 1926. (261,605.)

8,070. "Synchronous induction electric motors." British Thomson-Houston Co., Ltd. March 24th, 1925. (249,869.)

8,873. "Thermal-responsive devices for use in electric relays and the like." British Thomson-Houston Co., Ltd. April 4th, 1925. (250,260.)

9,234. "Electric operation and control of railway points." General Railway Signal Co. April 16th, 1925. (250,929.)

9,332. "Sound-reproducing apparatus, such as loud speakers." British Thomson-Houston Co., Ltd. April 20th, 1925. (250,931.)

9,440. "Junction sleeve for deep-sea cables." Felten & Guilleaume Carlswerk Akt. Ges. May 26th, 1925. (252,682.)

10,030. "Commutator or distributor brush holder for dynamo-electric machines." J. H. Cotton and J. W. J. Rogers. April 16th, 1926. (261,610.)

11,509. "Switches for electric advertising devices." N. Gollwitzer and S. Hamaguchi. May 3rd, 1926. (261,616.)

15,901. "Electric motor controllers." R. H. Barbour and J. R. Walton. August 25th, 1925. (Cognate application 15,912/26. Divided application on 21,263/25.) (261,646.)

17,327. "Valves for use in wireless telegraphy." J. A. M. Hawadier. July 10th, 1925. (255,698.)

17,393. "Cooling systems for dynamo-electric machinery." Metropolitan-Vickers Electrical Co., Ltd. July 23rd, 1925. (255,848.)

17,562. "Caps and sockets of electric lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 8th, 1925. (258,230.)

20,004. "Method of manufacture of electric insulators." B. G. Levis. August 13th, 1926. (261,669.)

24,686. "Distant communication cables." Siemens-Schuckertwerke Ges. October 6th, 1925. (259,574.)